The Vojta method of the 2nd generation

With Video Compendium

Václav Krucký

Supported by grant from Norway

Podpořeno grantem z Norska
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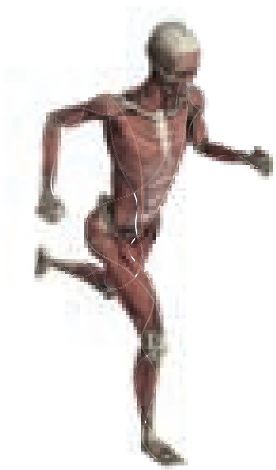
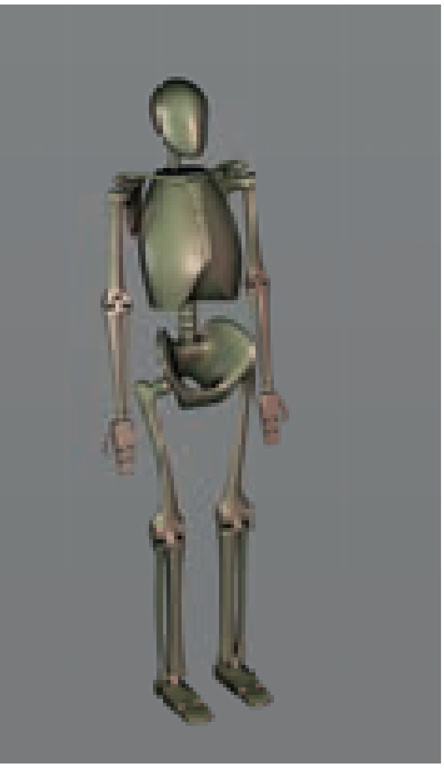
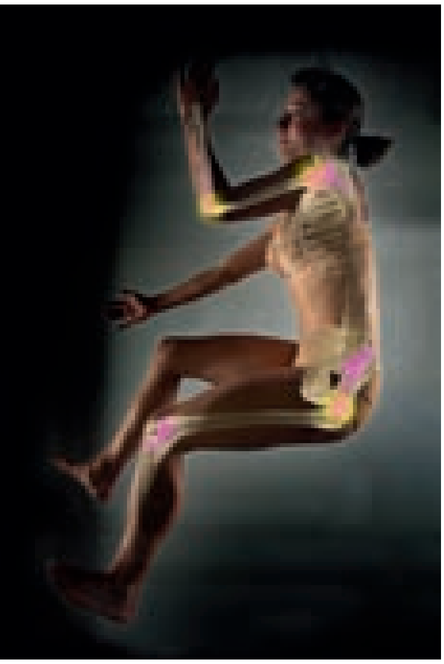
Table of Contents







Dedicated to my honorable predecessor
Dr. Václav Vojta

Dr. V Vojta with the author in 1991

Introduction

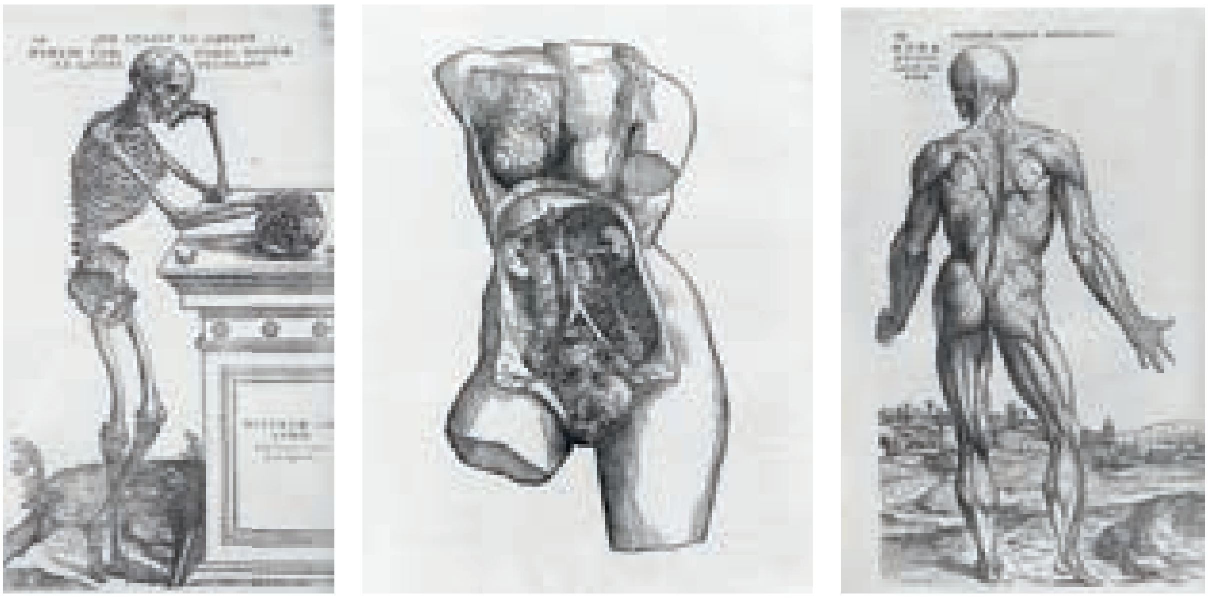
In 2005, I became aware of the growing chasm between the opinions expressed in the writing of Dr. V. Vojta and the existing view of the musculoskeletal apparatus. This was especially evident in how Vojta and modern anatomy, neurophysiology and biomechanics viewed human movement differently. These incompatible perspectives became even clearer as I practised therapy using the Vojta method myself. The more I tried to find an answer in the professional literature, the more ambiguity and doubts were raised, suggesting something was fundamentally wrong. It was a daring challenge, but I gradually came to find the pieces of a mosaic, which started to present the musculoskeletal apparatus and human movement from a brand new point of view. Movement was depicted in a 3D spatial perspective, or more precisely, it was portrayed as the functional representation of movement within the real three-dimensional space.

In this book, I would like to pursue my experience with the Vojta method that I've gained through several years of successful practice. However, the Vojta method cannot be explained in sufficient clarity without the broader knowledge of anatomy, neurophysiology, developmental neurology, biocybernetics, kinesiology – the science of human body movement – and biomechanics.

This broader context is called "conditio, sine qua non" – a precondition, without which the goal could only be accomplished with difficulty. It's a necessary precondition, though not a sufficient one.
Dr. Václav Vojta had started to publish his first findings about the use of "reflex locomotion" from the beginning of the 1950s. Over the years, the original diagnostic and therapeutic concept primarily targeted at the children suffering from cerebral palsy had been established… Gradually, the spectrum of diagnoses treated with the Vojta method became wider and the early diagnostic measures were fine-tuned as well. A risk of cerebral impairment can be detected during the first year of life of the child, which is early enough to prevent a range of possible harmful outcomes by well-timed therapy.
As the generation of Dr. V. Vojta enters the history books, there is no choice but to accept the baton and the related responsibility. It is customary that every upcoming generation contributes something new to the good legacy of the previous one. My personal endeavour is to further foster and develop the extremely positive legacy left by Dr. Václav Vojta.

I can only trust that the evaluation of the success of my effort would depend on the "fruit" it is going to bear.

Because of the didactic difference of the classical Vojta method and the Vojta method of our 2nd generation, I allowed myself to use the designation "Vojta Method of the 2nd Generation", represented throughout this book by the abbreviation "VM2G".



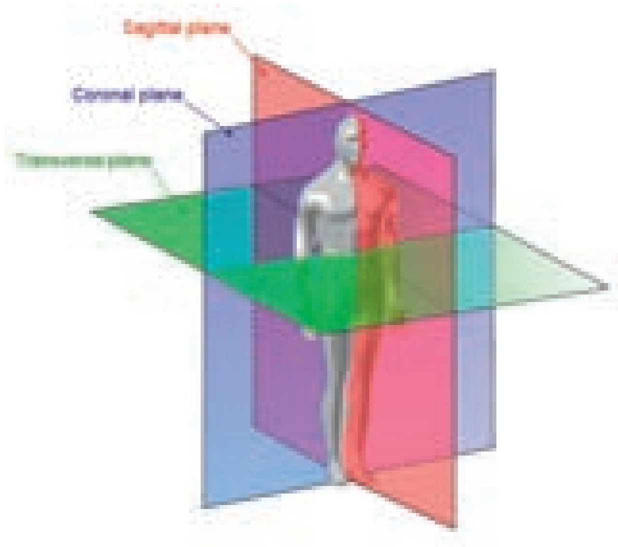
Andreas Vesalius: De humani corporis fabrica Libri septem (Basel, 1543)

For many years, I've been interested in several important interpretative questions surrounding the Vojta method that haven't been satisfactorily answered. Particularly, there have been unresolved issues concerning the theoretical foundation of the method in operation.

Current straightforward clinical application of "the well-established static ideas" about the musculoskeletal apparatus leads to results that can't be described as optimal, particularly with regards to the long-term sustainability of a proper function of the musculoskeletal apparatus. Although several other organ systems could be preserved and renovated in practical terms through transplantation through to the end of life, it is preferable to reserve comment about the existing possibility to maintain movement at a good and functionally dependable level up to this advanced age.
In 16th century, the anatomist Andreas Vesalius established the understanding of the functions of the musculoskeletal apparatus based on the descriptive anatomy of a corpse. These findings have held true until today. The descriptive measure of the locomotive apparatus in a state of "stillness" involves an analytical description within two-dimensional space. A fragmented description of the functions of individual muscles and the conception of the locomotive apparatus in a state of an inanimate "corpse" is surely fully suitable for the work of a surgeon, but it is completely insufficient for the general understanding of the musculoskeletal apparatus within its physiological functions, for example, the ability to stand upright on two limbs and to execute bipedal locomotion. Everything seems to suggest that the existing descriptive anatomy is not able to fully capture the real conditions and complex functions of the musculoskeletal apparatus.

What is the goal of the rehabilitative effort anyway?

Do we know what effect it has for a specific patient in his specific situation? What is the right posture of the body anyway? Is there any kind of "golden mean" towards which all decisions about the commencement and direction of therapy could be related? What should basic movement stereotypes look like? Apart from the subjective visual evaluation, there hasn't been any possibility of rendering the path of movement trajectories and their data processing in the clinical practice yet. How could the knowledge of spiral movement trajectories of individual limbs help to understand the movement trajectory of the whole human body, or more specifically, to "process the data" on the trajectory of the centre of gravity of the whole body? Will we ever be able to detect such trajectories? To standardise them, to set limits of tolerance, grades of pathological deviations, to verify them regarding the age and sex?

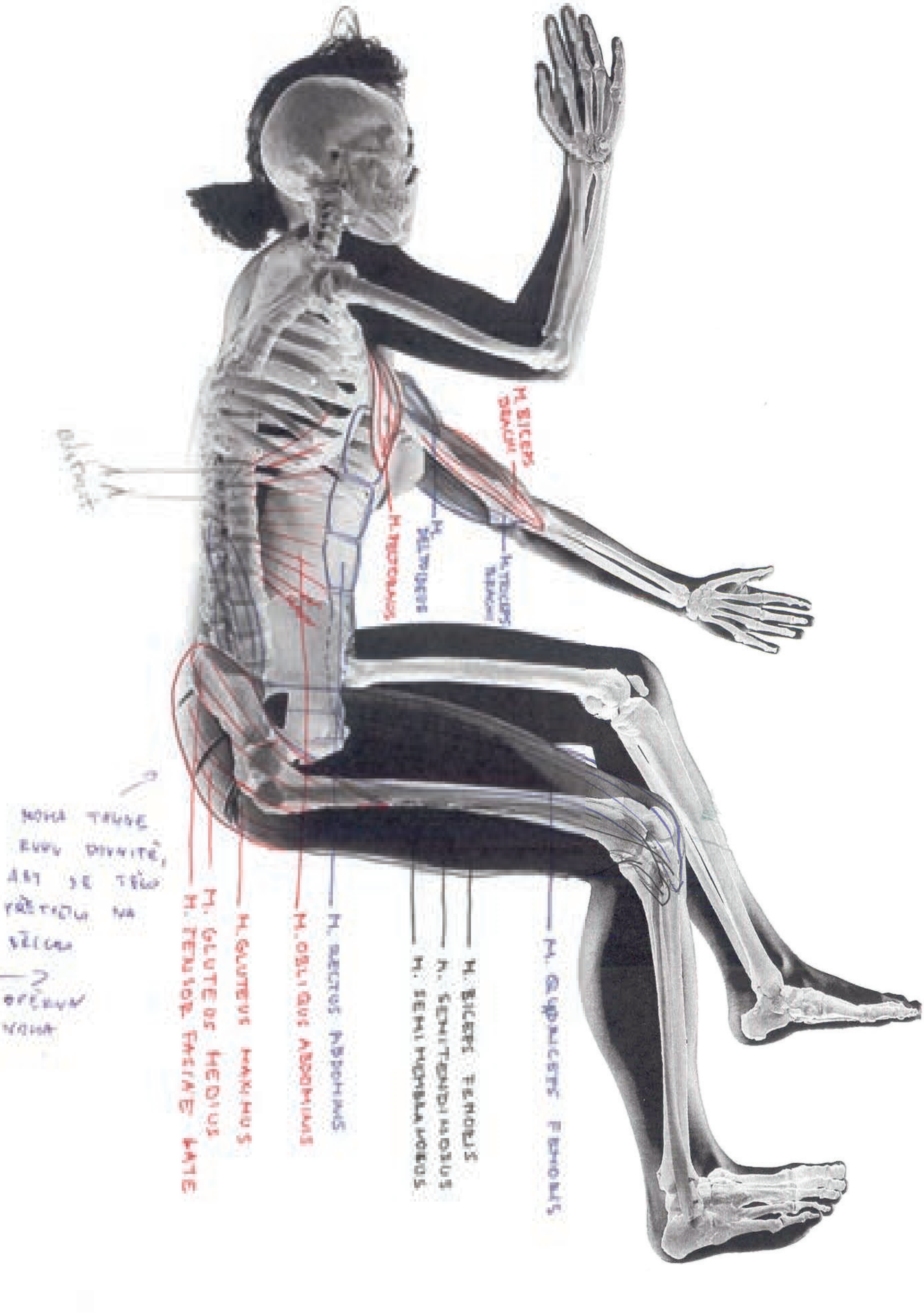


Author: Davud – Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=23553405

If no standards were set, the evaluation of the condition of the musculoskeletal apparatus would remain completely empirical and subjective.

It is necessary to "read" the locomotive apparatus as a whole. As with a mosaic, each little piece derives its meaning from its relationship to the whole. Similarly, each muscle's function arises within the movement patterns. Functions of each muscle are continuously changing within individual movement patterns. Current conception of muscle functions would not practically allow even the most essential functioning of the body, i.e. the upright posture, standing and gait.

A person would remain at the holokinetic level of limb motion, lying on his/her back or stomach depending on how he/she had been placed, because this individual would not even be able to even turn him/herself over.


M. BICEPS BRACHII
M. PECTORALIS
M. DELTOIDEUS
M. TRICEPS BRACHII
M. RECTUS ABDOMINIS
M. OBLIQUUS ABDOMINIS
M. GLUTEUS MAXIMUS
M. GLUTEUS MEDIUS
M. TENSOR FASCIAE LATAE
M. BICEPS FEMORIS
M. SEMITENDINOSUS
M. SEMIMEMBRANOSUS
M. QUADRICEPS FEMORIS

1. Vojta Method

1.1 History of the Vojta Method

“I haven’t invented it, I’ve just discovered it!” This sentence, with which Dr. Václav Vojta used to introduce his lectures, has become a well-known saying.

The Vojta method, often called “reflex locomotion”, is a therapeutic system elaborated by Dr. Václav Vojta together with his colleagues and pupils. The beginnings of the method reach as far as the turn of the 1950s and 1960s. In the former socialist Czechoslovakia, in the seclusion of the neurological clinic of the famous academician Karel Hener, a brand new approach to physiotherapy began to take shape. Children affected by cerebral palsy were the first patients of the new method and soon, thanks to early diagnosis, the therapy has also proved to be highly suitable for children threatened by motor development disorders.

The basics of the method come from the rational and logical principles of developmental kinesiology.

Repeatedly, Vojta used to humbly point out that he hadn’t “invented” the principles, he’d “only discovered” them. Several other authors had discovered the aforementioned principles before Vojta. Indeed, his undeniable credit lies in the systematic connection of theory and practice, which brought these theoretical principles to the wider awareness of the professional public, and in the remarkable influence on the thinking of other specialists.

As early as in the mid-fifties, Dr. V. Vojta discovered during his observations the possibility to invoke the muscular reflexes that could spread throughout the whole body. He called them global reflexes and started to use them to treat children suffering from cerebral palsy. The method known as “reflex locomotion” or the Vojta method has spread into several countries and its use has appeared to be successful in many other diagnoses.

← *Illustration of the body lying in the position on the side beginning to turn. View from below the lying body.*

1.2 Theoretical Foundation of the Vojta Method

Reflex stimulation that induces movement response within the VM represents brand new stimulus in terms of the psychological experience of the infant. Stimulation of active zones evokes reflex movement response. The child begins to experience very intensively that something is happening to its body. Something, it cannot influence with its will. Observations that I’ve made both during the stimulation and by analysing the video recordings of the therapeutic interventions, clearly show, that the initial surprise of the child is quickly replaced by displeasure expressed by the child crying and even screaming and with an effort to escape from the situation, which is uncomfortable mentally, physically and psychosocially.

In the first year of life, the child is equipped with a so-called "omnipotent" way of communication. Prof. Papoušek precisely addresses this kind of communication between the infant and its parent. [1]

During this period, the child communicates using a varied range of nonverbal expressions, movements of the whole body and hands, touches, facial movements, eye contact or conversely avoidance of eye contact, but most often through facial expressions and gestures. This kind communication on the part of the child conveys for all intents and purposes orders and aims to satisfy its actual needs. The ability to understand the communication of the infant by the nursing person is biologically given as it is triggered during the adolescence. It allows the parents and nursing person to practically and quickly comprehend the needs of the infant and to focus the behaviour towards their fulfilment. Performance of the reflex stimulation therapy, as it has been utilised within classical VM, leads to frustration of the infant by "disregarding" its omnipotent communication pattern. In this period, the child truly initiates, manages and accomplishes the communication with inherited nonverbal communication patterns.

I find the current way of performing the Vojta method therapy quite rigid, lacking sufficient and above all comprehensible communication with the child. If the child didn't receive a proper and comprehensible explanation that there was nothing wrong about the VM and that the parent had everything under control, it would become insecure and anxious. Resulting frustration is expressed by unease,

1 PAPOUŠEK, Mechthild. Regulationstörungen der frühen Kindheit. Bern: Verlag Hans Huber, 2004. ISBN 3-456-84036-5.




crying and even screaming. And it is crying, which demands an explanation and reassurance that the parent has the situation under control. It is necessary to communicate with the child throughout the exercise, although it is just not in mood for the exercise.

It often happens that neither the parent nor the child are not in the mood for exercise. It helps the therapy a lot when the parent is actively prepared to create a positive atmosphere without anxiety. He/she should be familiar with a sufficient repertoire of nursery rhymes, songs and poems. It is always useful, if there is someone else, e.g. a sibling, who can distract and deflect the attention of the child during the therapy. Regularity of the exercise also helps the child to get used to the mental and physical stress regarding its biorhythms.

Another unpleasant result of an approach that neglects the psychological needs of the child is the repetition of a frustrating situation, which leads to and reinforces the aversive reaction. Based on the negative conditioning, the undesirable phenomenon relates to unpleasant experience. Thus, mere preparations before the exercise become the impulses for crying and reluctance of the child to obey the exercise. Naturally, similar feelings begin to occur in the parent, who performs the therapy, and in the environment.

Stimulation that triggers an inadequate response in the child is also a source of its body's motor distress. It is manifested by

the effort of the child to escape from the uncomfortable situation. Through these flight reactions, the therapy becomes even more difficult. It is possible to keep the child in the reflex position only through an inadequate increase in pressure on the reflex zones. The therapeutic pressure, which is rather small in the resting infant, must be quite strong in the excited state. Concurrent effort to keep the child in the position and to control the course of the reflex leads to insufficient control of the pressure on the zones. Except the physiological reflex movement response, the increasing pressure on the reflex zones provokes an unpleasant or even painful sensation. Before this unpleasant feeling, the child increases its escape efforts, which repeatedly increases the effort of the parent to keep the child in the therapeutic position through increased pressure. This sequence becomes a cycle as the child gradually grows, gathers strength and begins to use its body more ably thanks to the therapy.

It is necessary to explain a neurophysiological mechanism involved. The child in its first year of life does not have a completed basic program of motor skills. Thus, it is not able to resist the reflex stimulation. The reflex

Video

Child performing the classical Vojta Therapy

bit.ly/2nnW2nQ

bit.ly/2nRs8tj

“overcomes” the child in this period of life. For several months, the performance of the therapy becomes the source of considerable frustration for the child, the parents and the relatives.

You could find a large number of written and recorded evidence on the internet, which would accurately document these joyless situations.

1.3
Implementing the Vojta Method Psychological Specifics in Toddlers and Preschool Children

Performing the classical Vojta method with toddlers and preschool children is quite difficult. The basic motor skill programs have been finished in this period. Thus, the reflex locomotion induced by the stimulation of active zones does not have such “power” over the child as compared to the previous infant stage. From the toddler stage, the child has been able to interrupt or even completely stop the induced reflex with its voluntary motor activity. For this reason, it’s so difficult or even impossible to carry out the Vojta method using the classical approach in many cases.

Between one and half to about four or five years of age, the cognitive abilities of the child are immature. There is practically no possibility of rational comprehension of the reason why the reflex stimulation should be endured and not disturbed. The child resists and escapes from the positions because the pressure-induced reflex movement is inconvenient for the child as it is not able to understand its meaning. If the intensity of stimulation increases to hold and fix the child in a given position, so does the induced reflex.

At the same time, the child begins to feel the pressure on the site of stimulation as painful. Thus, its effort to escape increases in this mentally and physically inconvenient situation. Soon, the parent usually gives up the whole therapy, because he/she does not find it meaningful to continue under these circumstances. Unfortunately, this approach leads to number of misunderstandings and to subsequent therapeutic “nihilism” accompanied by all the unpleasant consequences. To

Video
Child performing the classical Vojta Therapy

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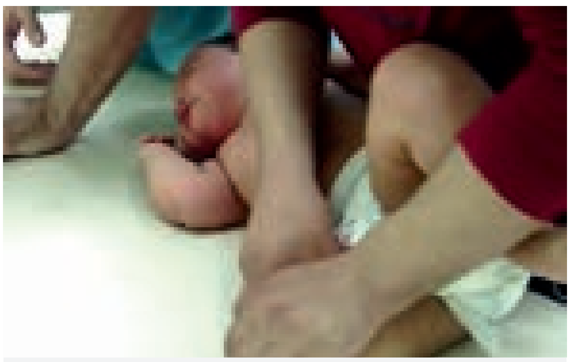

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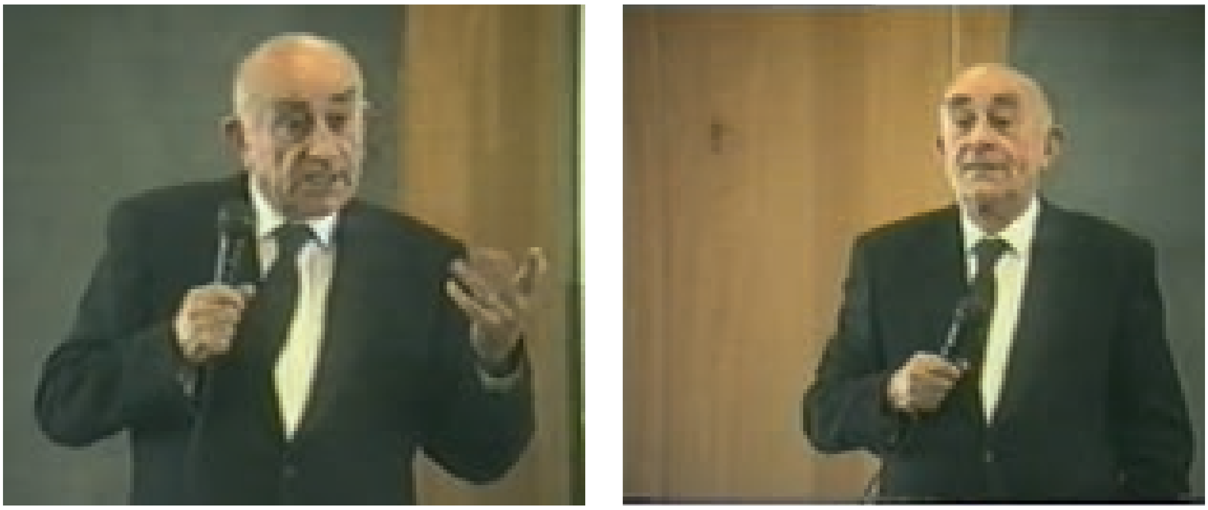
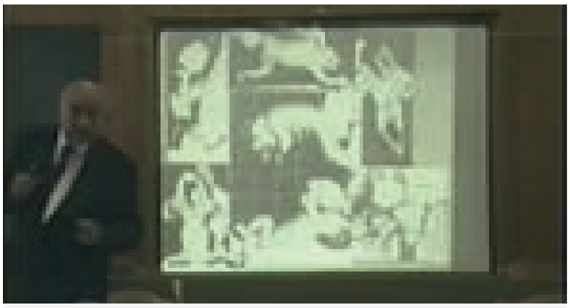


A lecture by Prof. MUDr. Václav Vojta

avoid inconvenient and frustrating situations even for them, some physiotherapists use “compassionate lies” and say that the Vojta method cannot work in this age. Afterwards, quite illogically, VM does work again, as soon as the child is grown enough to establish reasonable cooperation.

Again, the internet provides a large body of evidence and many videos about the effort to implement VM in this age.

Video



Václava Vojta’s
Video seminar
from 1991
bit.ly/2p416eU

1.4 Psychological Perception of the Therapeutic Stimulation by Parents Performing the Treatment by Close Relatives of the Child

Parents may have quite ambivalent experience regarding VM. On one hand, they feel that the development of their child is somehow threatened, particularly if the expert and objective findings were cause for concern. On the other hand, the stress of reflex stimulations performed three to four times a day is mentally and physically exhausting as they restrict leisure time and relaxation. Besides the common care of the infant, there is challenging, repeated and long-term therapy in addition. Moreover, the impossibility to delegate the care to other people (as with e.g. baby-sitting) induces chronic exhaustion.

The therapy is largely upon the shoulders of the mother. Fathers usually participate less. Generally, men don’t tolerate the therapy of the infants well. It is caused by a physiological mechanism. The crying of the infant increases their blood pressure as it forces the action “of rescuing the child”. Conversely, the therapy requires them to endure the crying and, in some cases, to contribute to the screaming through their own actions. Grandparents usually have less tolerance for the crying and screaming of their grandchildren. If they do not criticise and denounce "the treatment" as "child abuse", they usually quickly leave the area, where the therapy takes place.

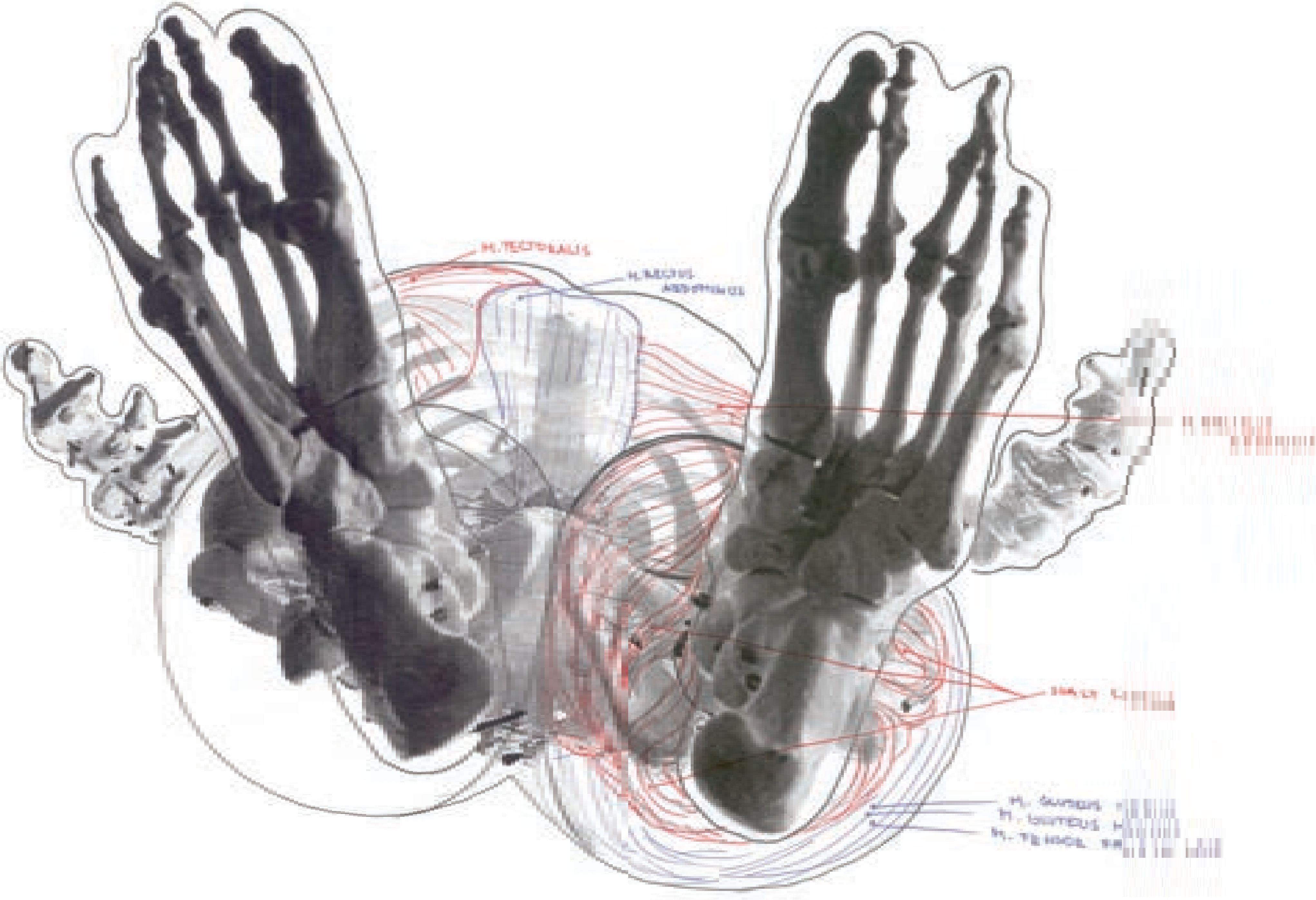
1.5 Psychological Stress Experienced by the Therapists Performing Reflex Stimulation Themselves and Supervising over the Therapy Performed by Parents

Physiotherapists who use the Vojta method endure a remarkable degree of psychological stress. They are the ones who take responsibility for the way the therapy is going to be performed at home. In the end, they share the responsibility for the future development of the child. This issue is even more difficult because during the infant's early stages of development, predominantly in the first six months of life, the risk of future motor development is visible only to the professional eye. It's up to him/her to persuade mothers and other family members that home therapy is necessary. Many years of experience show one fact that complicates the therapy: general paediatricians are not educated to perform the examination of early diagnostics implemented by Dr. Vojta in the early seventies. Take for example the education of paediatricians in early diagnostics of the infants.[2]

As for the implementation of the therapy, there is considerable stress caused by the diagnostic examination of the child and by its continuous evaluation.

Demands that therapists possess a high level of psychological and social skills during supervision of the parents as home therapists would require a separate chapter.

2 Recommendation by Prof. Komárek for pre-graduate education of paediatricians, paediatric neurologists and physiotherapists in early diagnostics of infants


M. PECTORALIS
M. RECTUS ABDOMINIS

2. Theoretical Part – VM2G

2.1 Habituation Processes and CNS Plasticity

Neurons in the CNS dispose of many habituation mechanisms when processing information. Adaptation processes lead to improvement through certain changes in the presynaptic and postsynaptic region, i.e. an increase in synaptic efficiency. They usually fall under the term "primary activation". It's a type of memory at an unconscious level, which influences and orientates an individual. It is the phenomena of repeated stimulation of certain neural pathways that increases the degree of stimulation effect of the same strength or that enables the stimulation of the neural pathways by an even weaker stimulus.

This term describes mechanisms, by which the synapses reach an efficient transmission relation through more frequent activation. This condition may last for minutes, hours or even several days depending on the specific adaptation processes of enhancing reactions that have produced it. All neurons in the CNS are connected to a network by synapses.

Other possibilities of adaptation involve, for example, building new synaptic bridges or reactivation of inactive synapses. Findings from in-vitro experiments on rat neurons provide evidence that support of neuronal synaptic activity is important for the generation of new connections between neurons.

← Illustration of the body standing on both soles. View from below the standing body.

We can assume that the condition of the synapses, their strength, density and activity significantly depend on the kind and number of afferent stimulation patterns. If adequate stimuli didn't arrive, the synaptic connections would decrease and the relevant circuits would perish.

To reach necessary CNS activity and to utilise developmental space (CNS plasticity), repeated neuronal network activation is necessary, as it subsequently complies with the adaptation process in a best possible (intrinsic) way. During the repetition of stimuli, the stimulation information heading to the CNS isn't identical in its processing, only similar. Creation of optimal movement in response to a stimulus must always be processed into the same movement patterns depending on the innate and activated program.

Integration of various sensory impressions shows another dimension of the complex CNS networking. There are specific stimuli necessary for individual sensory organs. Vision requires light stimuli, and hearing requires acoustic ones; smell needs fragrances, and touch depends on the application of pressure. Specific stimuli are received by receptors of the relevant sensory organ. They are then transmitted to the CNS. Yet, the corresponding cell bundles associated with the CNS regions don't function alone. Cell bundles of adjacent regions also contribute to organising and processing sensory perception, e.g., light stimulation and the interconnected ocular movement control or, as the case may be, the posture of the whole body. Thus, the networking relates to motor areas and their cell bundles because the ocular fixation is possible only through a coordinated contribution of ocular muscles through the corresponding posture of the head and body.

These complex processes could also be observed during therapy: to stay with the example of the eyes, activation of motor patterns of the torso and the head not only changes the ability of proper coordination of oculomotor muscles, (incorrect coordination leads to different types of strabismus), but also changes the ability of the eyes to focus. Again, that happens due to the influence of the normalisation of the muscle coordination of ciliary muscles of the lens.

The ingenious thing Dr. V. Vojta discovered is that there is something like an innate "backup repair program" in the brain, with which we come equipped at birth. This given property can generally be grouped with the other so-called auto-restoration mechanisms of the body such as the ability of a broken bone to heal or the repair of damaged skin. Since the normal and successful course of the healing process of the bone fracture needs to meet the conditions proven by the practice, i.e. the fusing of the bone fragments, rest and not carrying any load, meeting certain conditions is also necessary for "the start" and successful course of the treatment of the musculoskeletal apparatus with this backup program. Clinical practice has shown that the body should be brought into a previously specified position to initiate the repair program and subsequently, some of the several "trigger reflex zones" of the body should be stimulated.

In this way, reflex, i.e. involuntary, locomotion is induced. We can distinguish two types of these movements: reflex crawling and reflex turning that are subsequently differentiated into several modifications. Implementation of the technique of the crawling on all fours is still at its beginning. This is an isometric movement, as if we "froze" some real movement in its certain phase. This leads to higher efficiency thanks to the temporal and spatial summation of the stimuli that return to the brain.

Stimulation of the neuronal structures of the CNS could also be reached from given initial positions by the stimulation of so-called trigger zones. There are several trigger zones and trigger points on the body as they particularly affect the tensile receptors of the muscles and tendons, pressure receptors of the skin and periosteum and the receptor of the internal organs (interoreceptors). There are some other receptors that take part in triggering the repair program, i.e. equilibrium receptors (labyrinths) and the righting and balancing reflexes.

2.1.1 CNS Plasticity and its Relation to Developmental Habituation to "Hardware" Changes of the Musculoskeletal Apparatus

It seems likely that gradual somatic involutional changes are the interplay of the decrease in performance of both the "hardware" of the musculoskeletal apparatus and the "software" processes in the CNS. The level of gradual degradation is directly proportional to necessary adaptation of both parts, i.e. hardware to software and software to hardware, respectively.

Changes in the autonomic regulation of the posture of the body and in the stereotypical movements aren't just a result of changes that involve the musculoskeletal apparatus, but the changes of other tissues and organ systems participate in them as well. There are changes in the flexibility of the bone tissue, decrease in the tone of the smooth muscles of the digestive apparatus, restrictions in the ability to ventilate the apices of the pulmonary lobes, general decrease in vital lung capacity and other changes. Thus, it isn't possible to "push" the whole aging body to changes through exercise in an analytical way (strengthening and stretching) because these voluntary interventions don't take all the aforementioned aspects into account. For example, if the head is forced from an excessively forward position back to its natural position by the voluntary physical exercise, swallowing and vocalisation would feel unpleasant. This is because the autonomously controlled structures aren't subject to our conscious effort. Thus, it isn't quite possible to change their posture and the tone.

On the other hand, the CNS plasticity can provide the adaptation to newly established posture of the locomotive apparatus, both in the musculoskeletal and the internal organ systems, particularly within their tone and functionality. This would only be possible if it happened due to reflex locomotion, unconsciously and according to a genetically given program.

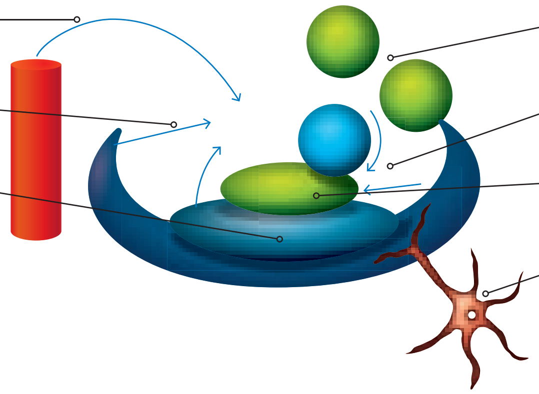
Figuratively speaking, the aforementioned possibilities of stimulation and positions constitute a system of keys and locks for movement programs.

The quality and intensity of the renewed programs of motion is directly proportional to reliability, availability and stability of the newly formed circuit connections and the density of the neuronal network in the CNS. Thus, it is necessary to repeat the daily dose of therapy. Thanks to repeated stimulation, the autonomic regulation of the posture of the body and the righting and balancing reflexes normalise. This subsequently enables the involvement of spontaneous motor skills and their stabilisation.

Significant influence of the therapeutic stimulation is also represented by the normalisation of perception of the body's arrangement. In children that can't experience normal development of the musculoskeletal apparatus because of a central motor disorder, the sensorimotor perception of the body is significantly distorted and supressed. The perception of the body's arrangement is also disturbed to a certain level in adult patients with a different aetiology of locomotive impairment. It is shown, e.g., in disorders of the autonomic regulation of the posture of the body or in impaired stereotypical gait. Reflex locomotion also allows the normalisation of the ability of differentiated perception of the body. This perception lays the foundation for learning new functions in both children and adults. It particularly enables the triggering of complex application programs of gross and fine motor skills. Remarkable benefit is also provided by the increasing confidence in the body's ability and "reliability", which grow during the therapy.

When assessing the extent of damage to the CNS, it is crucial to use the plasticity and the ability of the growth of the neuronal network. The extent of the anatomical damage and the actual functional loss don't have to bear a future negative prognosis. We know that in extensive anatomical damage, only mild functional loss may appear. On the other hand, minute anatomical flaws are often connected with far-ranging functional failure. Anatomical impairment doesn't necessarily provide reliable information about the developmental possibilities of the CNS.

A part of VM2G therapy includes the CNS, which is provided with multiple targeted long-term stimulations. The stimuli could be modified and multiplied in countless ways by variations of the initial positions, combinations of the trigger zones and changes in the trigger pressure. During every further use of reflex locomotion, even if only by a change in the position of the body, the CNS must adjust



Functions of the niche

to new requirements. Therefore, its activity is significantly increased.

The above-mentioned use of the plasticity in reflex locomotion seems to be particularly meaningful and potentially useful when the locomotive apparatus is in a repair phase, e.g., after intervertebral disc herniation. CNS tries to organise and compensate the impaired tissues through its new structuring.

To maximally restrain the incorrect regulation of motor skills and to prevent its future deviation, this phase of new structuring is particularly important in children. "False" substitute movement patterns haven't been established yet.

Thanks to the therapeutic influence of VM2G, the CNS will be offered the use of the physiological movement patterns. These are going to become a part of the basic operational program of motor skills, resembling the "patch" to repair computer software.

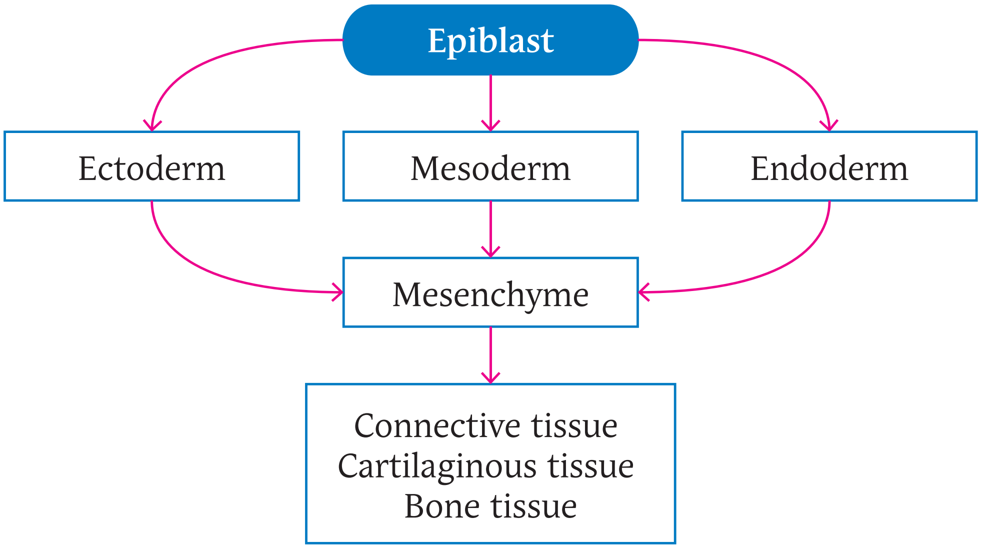
Particularly, there are significant possibilities of early therapeutic interventions in central coordination disorders of peripheral palsies, predominantly in the early months after birth.

For example, early initiation of the therapy is extremely important in a child suffering from birth trauma with brachial plexus palsy. Because of this brachial plexus palsy, the affected arm stays constrained for a longer period or it becomes completely incapable of spontaneous movement. If the therapy didn't start within 10 days, limited movement possibilities would set in. The child couldn't sense its arm at all or only partially. Thus, it doesn't turn around in this direction. The consequences could involve not only the incorrect sensorimotor perception, but also asymmetry of the body and possible subsequent damage.

Similarly, a defect of the inactive optic nerve occurs as it re-myelinates to a limited extent. This also applies to peripheral nerve disorders.

Every cell of the embryo, child or the adult patient has the complete genetic program, i.e. the theoretical choice to become any of the approximately 200 types of cells of the human body and belong to any of the five basic types of tissues. Centralised regulation of the morphogenetical processes in the developing and growing body doesn't exist from the beginning. It is restricted to smaller autonomous regions and it gradually centralises.

*The experiment demonstrated that the presence of a **microenvironment – niche** is necessary for the implementation of the multipotency of the stem cells of the differentiated tissues. The use of the stem cells in the differentiated tissues*



Morphological Methodology
Epiblast is a layer of cells of the germinal disc that develops into all germinal layers of the embryo.

would be very limited, unless this precondition was fulfilled. A niche can be represented by a miniature space that contains one cell, or it can be a much more voluminous space. A niche is created by adjacent cells, nerves running around the stem cells, capillary walls, molecules of various substances in the intercellular fluid (hormones, ions, growth factors, etc.). A niche is always slightly different from the surrounding tissue. In every tissue, there are a greater number of spaces with a suitable environment for survival of the stem cells, but after larger trauma, e.g. combustion, the niche could be damaged and the possibilities of further tissue repair would be reduced.

Function of the niche is represented by the regulation of the actions of the stem cells, creation of the environment for their survival and securing their fitness for further differentiation.

The microenvironment of the niche can also ***reprogram*** *the stem cells. It means, for example, the neural cell programmed for a differential neural pathway can be switched to the pathway of a muscle cell by the change of the niche and participate in myogenesis. As the tissue microenvironment changes, the behaviour of the stem cells changes, too. Stem cells can* ***age****, but they can also exhibit various features of their actual state. So-called* ***resting dormant stem cells*** *do not age and, under certain conditions, they are activated and become mature tissue cells. Conversely, activated cells can transform to resting cells with minimal substance exchange.*

A specific characteristic of the stem cells consists in their huge ***immunity*** *against damage to genetic information. The stem cells are provided with this feature by proteins responsible for DNA "repair", the proteins of detoxication system, antioxidant proteins, etc. According to current knowledge, stem cell of the adult tissues can be attributed several characteristics that can be partially used in the therapeutic practice: Stem cells possess the ability to essentially* *change their former **direction of development** depending on the environment they have been placed in. For example, neural stem cells change into blood elements within the blood environment.*

*Rather smaller numbers of cell populations can originate from the stem cells in **adult tissues**, particularly in their original tissue environment. It seems that "pluripotency" of adult stem cells is reduced compared to embryonal stem cells. **Embryonal cells** are closer to the totipotency of the zygote.*

*Stem cells in the differentiated tissues haven't been differentiated themselves, but they are far too differentiated to follow the development of a certain cellular line of pre-existing differentiated cell. They are called: **progenitor cell** or **– blasts** (fibroblasts, chondroblasts, osteoblasts, etc.). Their critical mitosis is asymmetrical, i.e. it creates two non-identical elements: another filial precursor cell and tissue cell that contributes to the cell cycle of the repaired tissue.*

***Regeneration** – the renewal, healing of the damaged and lost tissues or even the recovery of the parts of the organs is also partially possible in humans, but the regenerative capacity of the tissues and organs quickly decrease in the postnatal period. It is not known whether different or essentially modified processes are employed during the regeneration of the adult body than the fundamental **morphogenetic processes:** cellular proliferation, distribution, interaction and cellular reduction. No tissue specific "regeneration morfogene" or specifically acting gene cluster have been identified yet.*

Irregular decrease in regeneration capacity of the tissues in the postnatal ontogenesis haven't been sufficiently explained yet.

I think that the clinical results achieved by the implementation of the VM2G therapy in patients in different age categories and various diagnoses may point out the fact of the function of reflex stimulation as a global program of regeneration and repair of many tissues and organ systems. The explanations of this regeneration ability must be further studied because the essence of this regeneration ability could be just the ability of the body to utilise the stem cells for repair.

Based on the many years of clinical practice I think that as the genetically predetermined developmental program responsible for the development of a child from birth to adulthood.

The results of experimental morphology and growth studies of transplanted organs indicate that, except for the tissue hormones and IGF type of growth factors, there are several other occasionally detected factors and many locally released polypeptides that haven't been successfully isolated and their specificity and effectivity haven't been defined.

*Individual, more or less definable growth patterns represent just **a schematising of the growth process.** If we accepted the existing classification, we would do it with the acknowledgment of the fact that the growth in its "clean form" is implemented particularly in the early phases of the ontogenetic development.*

The developing limbs could serve as an example of the gradual integration of the growth patterns. Mesenchymal cell population of the limb bud grows zonally and the covering ectoderm grows interstitially. Multiplicative growth combined with zonal growth activity is typical for the formation of the organ foundations, e.g., bones and the resulting shape and the position of the whole limb.

In the end of the prenatal period, all growth patterns "weld" together – integrate. Growth integration is not typologically proportional and could differ even within a single tissue system.

Ema and Ela seven years old

There are no greater differences among the growth activities of different types of tissues in this period. For example, the majority of neurons terminate their multiplicative growth in the early postnatal period, but a neuron in hippocampi can multiply through to adulthood. Type I pneumocytes divide during the whole childhood, and the stem cells of the bone marrow keep their lifelong division potential. Multiplicative growth is regulated by two types of substances:
***Extrinsic factors** produced by remote tissues, e.g., hormones, and the **intrinsic, local factors** with paracrine effect, e.g., the substances produced by vascular endothelium act locally, insulin-like growth factors (IGF-1) too, etc.*
The spatial and temporal consequences and the harmonisation of the extrinsic and intrinsic factors regulating the multiplicative growth, haven't been sufficiently understood yet.[3]

3 DYLEVSKÝ, Ivan. Anatomie dítěte, Nipioanatomie, 1.díl

2.2 Case Study – Ema and Ela

2.2.1 Illustration of the Therapy of the Prematurely Born Twins

Ema and Ela were born via caesarean section in the eighth month of pregnancy. It was obvious very early on that their development didn't conform to medical norms. The paediatrician recommended neurological examination and physiotherapy. Both children began their rehabilitative exercises during the third month after birth, so therapy started in time. Ela's condition improved quite early, and she started to stand up in the tenth month. Despite the early onset of therapy and the intensive home exercise, Ema's condition got worse. At ten months of age, she was only able to crawl with the help of one hand. Repeated neurological examination showed increasing risk of development into unilateral cerebral palsy. Comparing the development of both girls, it was obvious that Ema's development went in the wrong direction.

2.2.2
Clinical Description of Problems

Her progressive development and previous medical history showed that Ema suffered from a severe form of central coordination disorder. Ela's initial unfavourable condition began to improve quite quickly, but the comparison of the development of both twins only confirmed the disorder. Neurological reports spoke of an unfavourable condition, particularly in Ema's case. The ongoing examinations performed at our office clearly showed that there was a severe central coordination disorder. There was a gradual unilateral progressive increase in muscle tone. Opisthotonus didn't retreat, and primitive reflexes persisted unilaterally. Spontaneous locomotion was impaired when both prostrate and supine. Primitive reflexes could be triggered quite vividly, particularly the reflex of Moro. Responses to positional tests were abnormal.

2.2.3
Expert Explanation of the Problem

Prematurely born children face a number of medical dangers, predominantly the impairment to the future psychomotor development. The persistence of primitive reflexes is especially a very severe warning sign about the impairment of motor development because these primitive reflexes constrain the healthy physiologic development of motor skills. Impaired regulation of the spontaneous motor skills makes it impossible for the child to assume a stable resting position while lying on its back or stomach. The immaturity of the postural motor autonomic regulation is a common source of psychological unrest of the child. Its brain is "under the command" of primitive reflexes. Quite early on, the brain starts to use substitute movement programs for its development that lead to substitute pathological movement combinations. This unhealthy coordination results in pathological stereotypical movements. Impairment of the basic stereotypical movements of gait, grasp, breathing and even the orofacial region occurs. Both gross and fine motor skill regulation with

Video
Ema and Ela Cihlářová (shorter version)

Cihlářová Ela
vm2g.cz/cihlarova-ela

Cihlářová Ema
vm2g.cz/cihlarova-ema

all subsequent impacts on musculoskeletal apparatus are disturbed. Early and repeated diagnosis of the condition of the basic motor skill programs based on the developmental kinesiology can show not only the actual status of the child, but even propose the exact outcomes. This type of primary diagnostics becomes a continuous method of examination that can precisely monitor the development of psychomotor functions and confirm the correctness of the chosen therapeutic strategy. The therapist that treats the infant patients must by necessity be an excellent diagnostician. The therapy within VM2G is targeted at the normalising of the development of locomotion in accordance with the rules of developmental kinesiology. In the end, the goal is to "switch off the substitute program of locomotion" that impairs the regulation of the muscle coordination and tone. This should allow the physiological program of motor skills to be "loaded". Thus, the normal development of locomotive apparatus should be restarted.

2.2.4 Illustration of the Solution

In the first months, the therapy was carried out on both twins in an identical manner. In the eighth month, it was obvious that Ela's condition practically normalising, but conversely, Ema's condition began to significantly worsen. The schedule of the exercises changed and Ela exercised only once a day. Ema's exercises intensified to five times a day. The exercise had to be performed by both parents together, while the girl had grown bigger and her mother couldn't handle the exercise on her own. Hence, the father modified his working hours so he could come home and exercise with the children during his work breaks. This extremely challenging therapeutic regimen took almost three months. Only then were there some gradual improvements in Ema's condition and we could decrease the intensity and the number of exercises. After the patient's 15th month of life, her motor development normalised completely. Overall, the therapy took thirteen months.

2.2.5 Explanation of the Solution

The initial condition of both children, which hadn't seemed to be severe, changed to very severe condition in Ema's case. This pathological progression was confirmed by repeated neurological check-ups. Thanks to the extraordinary effort of both parents in their therapeutic endeavour, Ema managed to avoid risk to the motor development and gained complete, normal function of the locomotive apparatus in all its components. The therapy was extremely difficult for the parents and child, primarily during the phase requiring the involvement of both parents in the exercise. The therapy required a strong will, discipline and a great amount of self-denial. The performance of VM2G initiated the repair processes in the CNS. In this case, the stimulation activity targeted the processes in the CNS – the neurogenesis and the prevention of apoptosis of immature neurons. By utilising the genetically given motor skill programs, it is possible to provide the stimulation with maximum efficiency and with no risk of overload. This is extremely important in children with severe central coordination disorder.

2.3 The View of the Prognosis, Diagnostics and Therapy in Children at Risk of Development of Severe Motor Developmental Disorder

It is necessary to initiate very intensive VM2G therapy in infant patients, who show severe symptoms of neurological impairment. Most often, the temporal and spatial summation of the therapeutic stimulation is combined. For this therapeutic strategy, it is essential to have a cooperative home therapist, who would offer practically all his time to the treatment goal. In the above-mentioned case, it was necessary for both parents to participate in exercises for some time. Intensive and long-term brain stimulation is probably the only possible solution that restarts the neurogenesis, ceases the process of apoptosis and neural network damage. Intensive stimulation with VM2G permanently inundates the brain with activity because, after every stimulation with exercise, the reflex activity in the cerebral centres continues for two more hours (Vojta, 1974)[4]. Our experience has shown that children who underwent the VM2G therapy happened to follow completely normal motor development up to normal bipedal gait regardless of the degree of the risk of CCD.

4 VOJTA, Václav. Mozkové hybné poruchy v kojeneckém věku. Praha: Grada, 1993. ISBN 8085424983

3. Physiological Developmental Kinesiology

Developmental kinesiology predominantly with a focus on the period of the first 12 to 18 months after birth is a significant contribution to the study of movement and to the therapy of locomotive disorders. Of course, the development of motor skills takes place during the intrauterine life and continues after the 18th month of life throughout the whole childhood and whole life in a sense. According to actual knowledge, the first 18 months after birth seem to be the most important because the fundamental changes that determine the upcoming development take place in this period.

Innate, genetically determined movement programs provide the basic bodily requirements. Beside these survival programs, the child is gradually able to establish contact with its surroundings, e.g., by smiling at its mother or, conversely, crying in frustration.

According to Vojta's conception, the child is born with rather sophisticated movement programs and implements them gradually into its motor skills. Kolář [5] states that with suitable afferent stimulation, the child could be led to a postural situation, in which it would perform a movement it wouldn't have been able to perform until during the next level of its later development. On the other hand, there is an opinion stating, that the brain of a new born is something of a "tabula rasa", containing only very simple movement patterns. The child builds its motor skills on them through contact with its surroundings by trial and error. Innate interest in the surroundings, curiosity, yearning for orientation and establishment of the contact and communication are of fundamental importance. All these features constitute the essence for inborn effort to stand upright that is obvious in every healthy child.

The balance between the normal and pathological development is predisposed by intrinsic and extrinsic conditions. Intrinsic conditions contain genetic talents (thus, the respective inborn motion programs) and the features that have been obtained during the previous ontogenesis. Extrinsic conditions involve the satisfaction of basic vital needs (food, warmth, light) and a sufficient amount of outer impulses that would stimulate and satisfy the child's interest in its surroundings and its own body. Normal genetic makeup, normal extrinsic conditions and normal previous development of the individual constitute the necessary preconditions for normal development. Not fulfilling them urges the use of substitute and compensatory mechanisms of the body.

The development of the child in its first year of life is characterised by its gradual adoption of a vertical stance associated with a narrowing of the support base and increasing lability of the position. Optimally, this stance relates to righting from the existing flection position and inner rotation of the root joints of the limbs to straightened posture, allowing outer rotation in the root joints of the limbs.

5 KOLÁŘ, Pavel. Rehabilitace v klinické praxi. Praha, 2009, Galen, ISBN 978-80-7262-657-1

← Illustration of the running body supported on one foot with presumed course of the muscle spirals.

Upright posture is primarily maintained thanks to the so-called postural muscles. During optimal development, phasic muscles join this function too. Their involvement places great demands on the control functions of the CNS. It would be insufficient if the course of development was incorrect or the CNS control functions were impaired. In this case, the proportion of the phasic muscles involved in the utilisation of the upright posture decreases as the proportion of the postural muscles increases. This is reflected by typical clinical findings.

Although the upright posture puts greater demands on maintaining balance, it provides an improved sense of orientation, and it frees the hands for grasping objects of interest. Also, it makes more effective locomotion possible (Vařeka, Dvořák, 1999).[6]

According to Vojta, every human locomotion (i.e. also reflex locomotion) contains three inseparable parts: muscle tone, postural activity and postural reactivity (Vojta, 1993).

Vojta's (locomotion) principle describes three basic parts of locomotion: *postural activity* as an ability to assume an active upright posture; *postural reactivity* as an ability to maintain the active upright position and adequate *muscle tone*, which is the essence of all motor skills.

Meeting the above-mentioned preconditions is necessary not only for providing quality locomotion, but for providing quality contact with the surroundings and finally, for quality basic vital functions.

3.1 Posture, Postural Activity and Postural Reactivity

The prerequisite of upright posture is the ability to create a common centre of gravity for the segments of the body and to maintain its projection within the supportive base. This ability is provided by the activity of the muscles controlled by the CNS. Before performing a certain movement, a man should be able to assume

6 VAŘEKA I., DVOŘÁK R. Ontogeneze lidské motoriky jako schopnost řídit polohu těžiště.

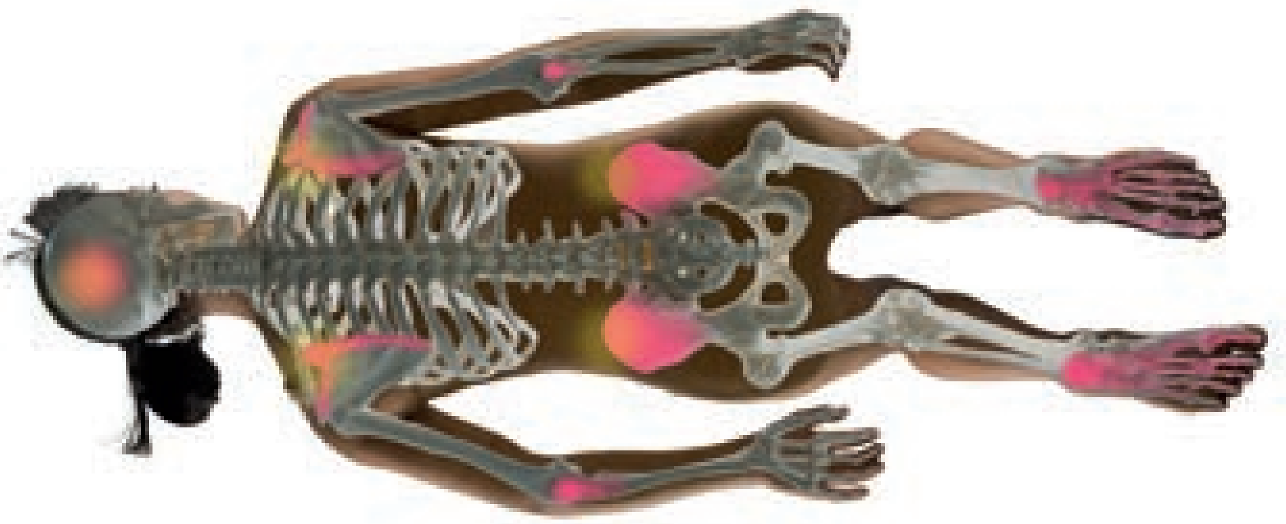


Illustration of the body in the supine position (view from below) with indicated supporting points at the occiput, scapular margins, elbows, pelvic alae and soles an active position first, which could be called the *posture*. The adjective "active" is important here as it differentiates posture – the active position – from the passive position (e.g. "stabilised position" for transportation of an unconscious person). Every person assumes a posture spontaneously (if he/she wasn't in a deep state of unconsciousness), even when sleeping. This ability could be called *postural activity*.

The term *postural reactivity* refers to the ability to react to extrinsic or intrinsic changes and to maintain the existing active position or to take a new, more advantageous one.

Attitude is a guided change in posture before the initiation of the movement, when the very movement hasn't happened yet. This activity could be demonstrated by, e.g., EMG examination. Nevertheless, even without a complicated technical apparatus, it is possible to presume what move the observed person is going to make. For example, before stepping forward, the person transfers the weight above the now imminent supportive lower leg and releases the other limb for the next step. Concurrently, the person takes the corresponding posture of the torso, upper limbs, neck and head. Adequate muscle tone is an inseparable part of posture, which constitutes the essence of all motor skills. Thus, we can deduce that: posture + movement anticipation = attitude.

The (targeted) movement represents physical locomotion that is based on the attitude and posture, respectively. The quote *"Posture follows the movement like a shadow"* is attributed to either Sherrington or Magnus. According to Janda, in 1906, Sherrington stated: *"Posture follows movement like a shadow"* (Janda, 1982, 54). Vojta quotes the Magnus speech at the Royal Society in London

from 1916: *"Each accurate movement starts from a definite posture and ends in the posture. More then, the posture follows the movement like a shadow."* (Vojta, 1993, 31).

The question of primacy is interesting, but it isn't so important. The content of these words and their correct understanding are a more crucial matter. The Czech translation is misleading and it could lead to false interpretation that the posture is secondary to the movement and divided from it. The posture is always in both the beginning and the end of any movement (refer to Magnus) and at the same time, one of its components.

Spontaneous motor development of a child from the birth to the end of the development passes through essential milestones and is accomplished with:

- The upright position of the body
- Unaided bipedal gait.

These milestones could be described by changes in:

- The level of the regulation of the motor skills
- Anatomical conversion of the musculoskeletal apparatus
- Biomechanics of the locomotion
- Geometry of the body.

For the needs of the developmental kinesiology, the classification introduced by Vojta is routinely used. It classifies the sides of the body into:

- Mandibular side
- Occipital side.

Classification of the points of support and points of motion:

- Punctum fixum (PF)
- Punctum mobile (PM)

Supine position

Punctum fixum:

- Nape
- Both scapulae
- Both pelvic alae
- Both soles and elbows.

Supine position

Punctum mobile

- Points of motion occur during the elevation of the hands (e.g. towards an offered toy);
- And feet subsequently (also while trying to grip something);
- The position is highly stable – support in 5 to 9 points.

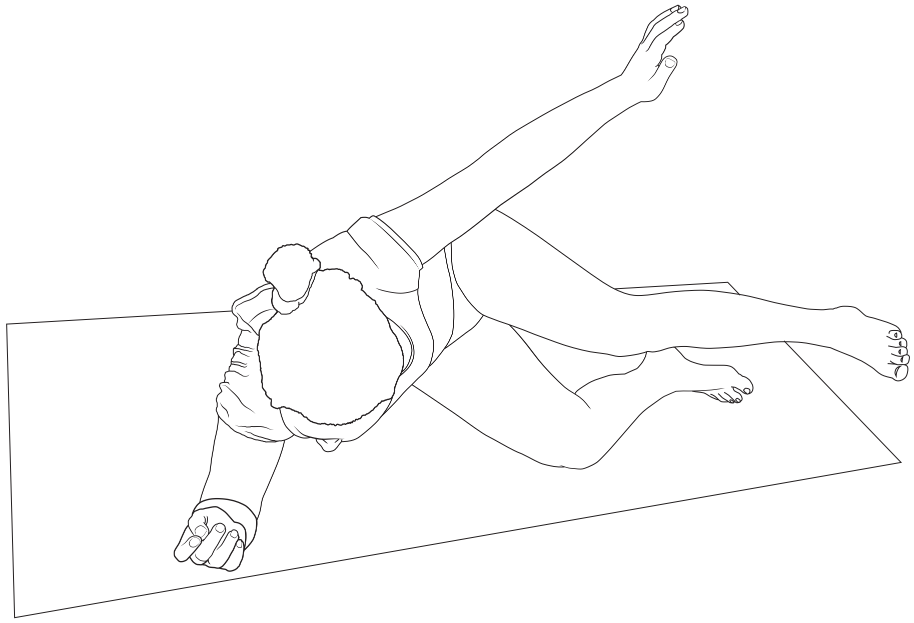
Turning

Initiation of the turning from the supine position to the side is followed by a change of points of support and the points of motion; the movement is initiated with the turning of the head, or in some cases the movement of the eyes, towards an object of interest.

PF On the head, it is released from the support to let the head turn;

PF The pelvic and scapular PFs release from the support at the mandibular side of the body so that the mandibular half of the thorax and pelvis starts to be elevated;

PFs At the occipital side shift from the



scapular region to the shoulder joint and from the pelvic region to the hip joint. New PF origins at the elbow of the upper limb at the occipital side of the body; That's how the support in three points forms (hip, shoulder, elbow), which is less stable, but it enables the transition to the new four-point stable position (hip, shoulder, elbow and the knee on the occipital side).

PM The hand on the mandibular site becomes the "leading" PM;

PM Both lower limbs become "aiding and balancing" PMs.

Position on the side

Stable position that enables the hand on the mandibular side to become the "exploring" hand in the space in front of the face. The first functional differentiation of the upper limbs to supportive and phasic function is being formed. The support has 4, or in some cases, 5 points. The head resting on the side makes the 5th point.

PF The occipital upper limb has its PF at the shoulder and at the elbow.

PF The occipital lower limb has its PF at the hip and at the knee.

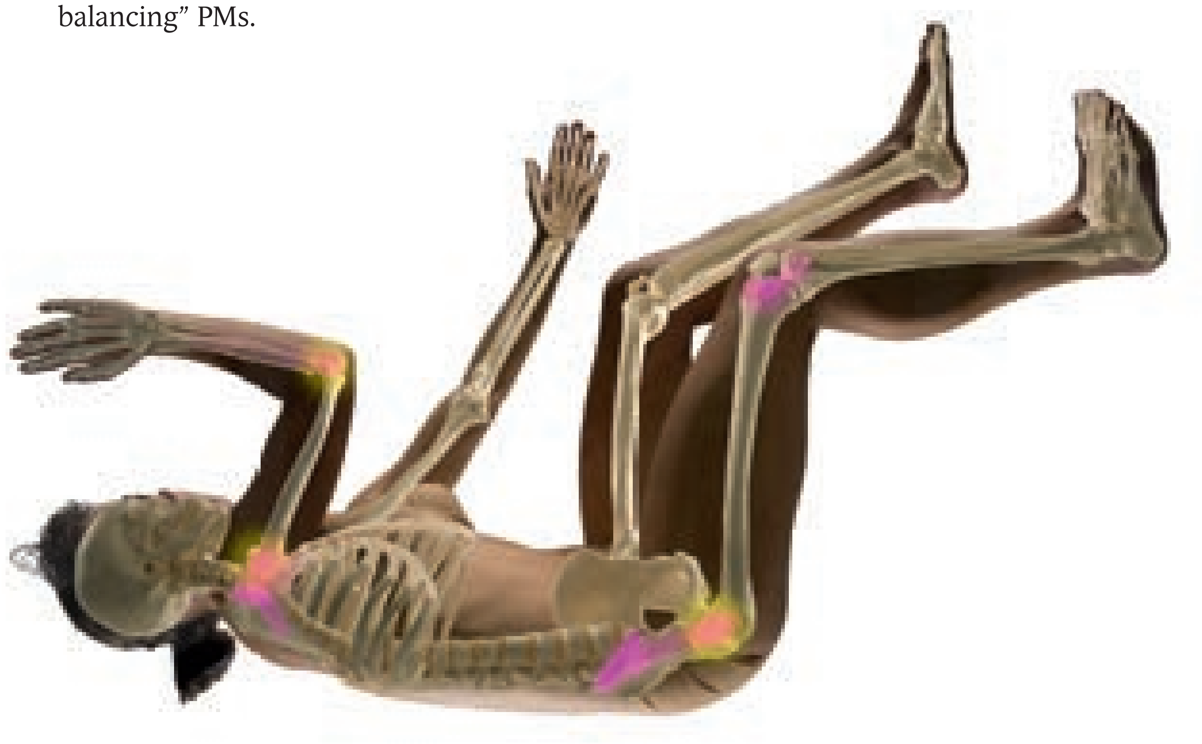


Illustration of support surfaces in the lateral

Position on the side

PM The head gets out of the support (for a while), and the visual perimeter is elevated;

PM The hand on the mandibular side has the range of motion above and to the front;

PM x PF Foot on the mandibular site varies between the possibility of support on the knee and the possibility of the movement that would enable returning to the safe position on the back or turning on to the belly.

Turning from the position on the side to the belly and back:

Support on the PF at the elbow on the occipital side would release the load at the shoulder and the whole chest becomes a PM.

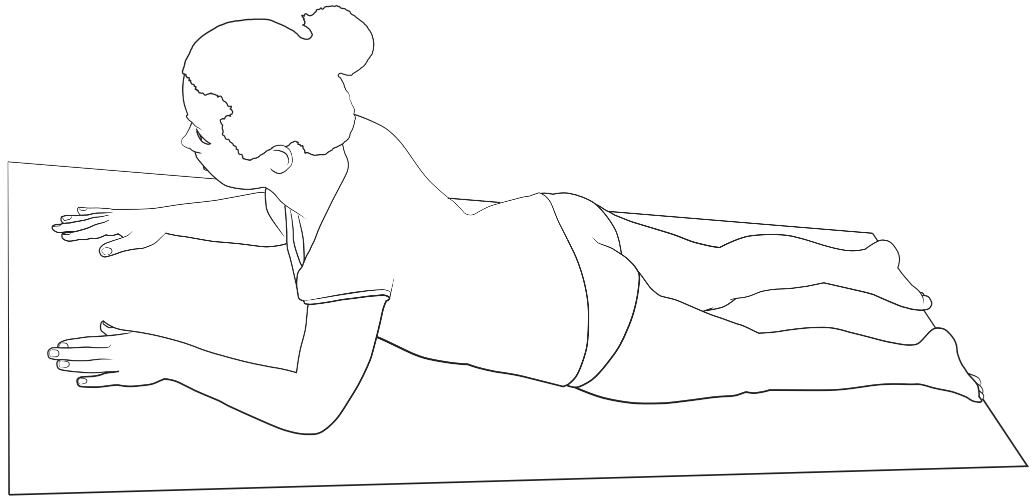
PF at the hip joint at the occipital side becomes the support for this unstable situation;

PF at the knee on the occipital side begins to shift caudally as the lower limb extends;

PM on the hand on the mandibular side accomplishes the turn to the belly;

PM of the foot on the mandibular side helps to turn the pelvis on the belly, while the lower limb extends fully.

prone position



Position on the stomach –
3rd to 5th month of development

Stabile position on the stomach is provided by the support of the upper limbs at the forearms:

PF Elbows including the whole surface of the forearms;

PF Pelvic symphysis forms another important support;

PM It's the head and its free posture on the extended nape that enables significant widening of the rotation of the cervical spine and thus the visual perimeter.

Position on the stomach –
5th to 6th month of development:

A change in the support takes place.

PF They shift to the open palms of both hands;

PF At the symphysis it shifts toward the posterior;

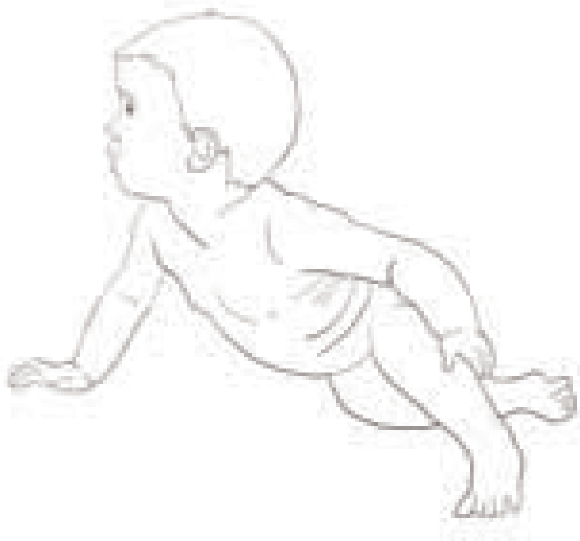
PM The head allows a view from "the upper floor"; the extension of the cervical and thoracic spine increases the range of rotatory movement of the vertebrae and thus there is further increase in the visual perimeter.

Position on the stomach –
5th to 6th month of development:

There is another change in the support that enables the release of one hand from the support to enable the grip.

PF It stays at the occipital upper limb and the whole surface of the forearm;

PF It shifts from symphysis to the hip joint on the occipital side.



Position on the stomach – 5th to 6th month of development

PM the head;

PM the hand on the mandibular site releases from the support and becomes the "grip organ" that satisfies the explorative needs of the child. The hand begins to have the ability of stereognosis. Until then, the child's mouth served as the only possibility to explore the outer world.

Transition from the position on the stomach to the oblique sitting – 8th month of development

The oblique sitting position enables the transition to crawling on all fours:

PF It is at the open hand on the occipital side;

PF It is at the hip joint on the occipital side;

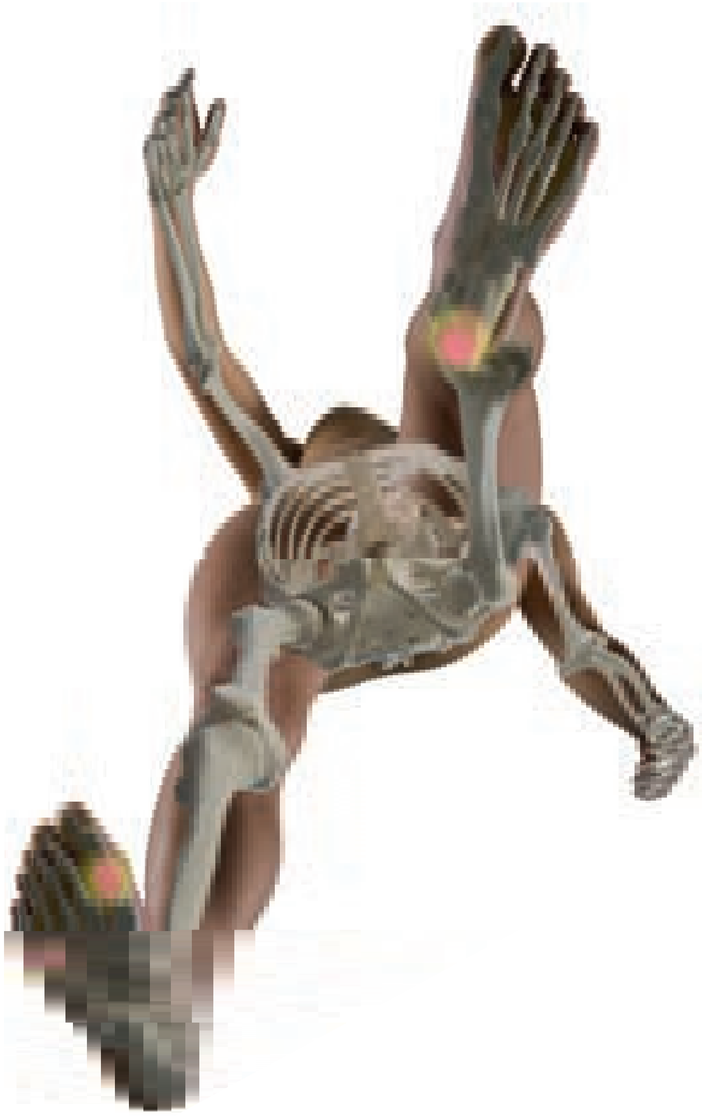
PF The whole surface of the thigh and the knee on the occipital side;

PM It's the head that gets to higher position again. The whole cervical and thoracic spine is extended and enables an increase in the rotation and wider view;

PM The hand on the mandibular side gets into the vertical axis above the head.

Unaided standing with no support

Unaided bipedal gait



Crawling on all fours –
9th to 10th month of development:
It is enabled by full differentiation of the function of the support and movement in both upper and lower limbs;
It is basic precondition for the upcoming bipedal gait;
PF support on the extended occipital hand;
PF support on the knee of the mandibular leg;
PM occipital leg;
PM mandibular.

Illustration of the running body; supporting points at the heel and the heads of 1st and 5th metatarsi are indicated.

video-compendium of the 1st year of development
bit.ly/2mCImqc

4. Pathological Developmental Kinesiology

The pathology of motor development is most pronounced in the disturbance of the ability of physiological extension and the associated rotation of the spine. The subsequent impact of impaired development is pronounced within the normal range of rotation in the root joints (shoulder and hip joints). Further, this impairment spreads into the acral joints of the limbs. That's how the major pathological change originates in the global motor skills of the body.

Disorders of autonomic regulation of the joint centration are manifested as follows:

- Disorder of autonomic joint centration, in terms of both static and dynamic centration
- Predominance of inner rotation, particularly in root joints
- Predominance of adduction, most noticeable in the hip joints
- Predominance of flection
- Predominance of ulnar deviation in the posture of the hand
- Restriction of supination of the forearm
- Restriction of physiological range of motion in the joint
- Gradual development of joint subluxation or luxation, most often in hip joints
- Impaired anterior head posture
- Impaired posture of the mandible, most often in the retrogenia

← Illustration of the impaired autonomic regulation of the posture of the body with oblique posture of the pelvis; hip joints are rotated inwards; there is a deviated posture of the axes of the knee and ankle joints.

Illustration of the pathological posture of the body of the infants in the supine position

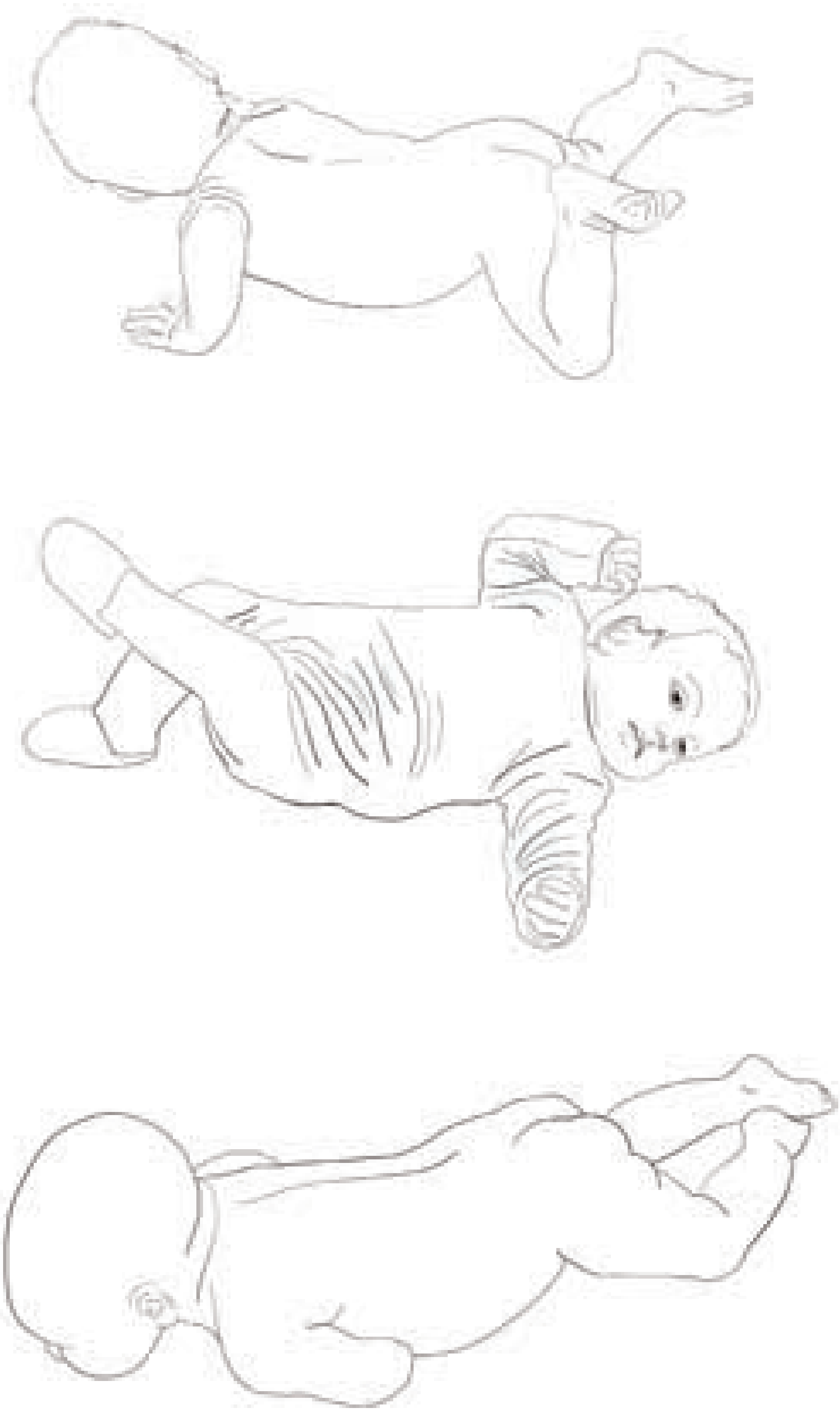


Illustration of the pathological posture of the body of the infants in the supine and prone positions.

Musculoskeletal disorders are visible in the incorrect posture of the body at all levels:

- Collapse of the arches of the feet
- Deviation of the axes of calcanei and tarsal bones and digits
- Deviation of the axes of feet on the inner side
- Deviation of the axes of the long bones of the lower limbs
- Deviation of the axes of the knees
- Inner rotation in the hip joints with relative shortening of the lower limbs.
- Lateral tilting of the pelvis
- Axillar rotation of the pelvis
- Flection posture of the pelvis causing functional shortening of the lower limbs, and its rotation
- Hyperlordotic posture of the lumbar spine
- Lateral deviation of the axis of the lumbar spine
- Axillar rotation of the axis of the lumbar spine
- Hyperkyphotic posture of the thoracic spine
- Impaired configuration of the chest
- Impairment of the spinal axes
- Impaired postures of the shoulder girdles in an uneven height and in the protraction
- Impairment of the stereotypical respiratory movement
- Impaired configuration of the chest
- Impairment of the autonomic posture of the lower limbs and the left hand
- Severe disorders of the autonomic regulation of the posture of the body
- Immediate change in the autonomic posture after the therapy
- Impairment of the autonomic regulation of the basic stereotypical movements
  - Gait
  - Grasp
  - Respiratory movements
  - Orofacial stereotypical movements
  - Swallowing
  - Chewing
- Impaired dental occlusion
- Impaired development of speech, singing, playing the wind musical instruments

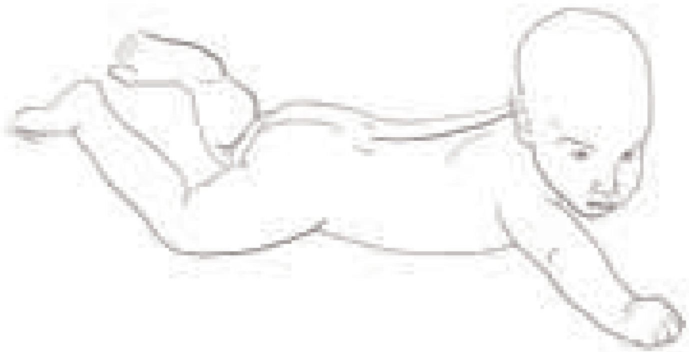


Illustration of the pathological posture of the body of the infants in the supine and prone positions.

5. General Kinesiology of Adults

The ideal development during the first year of age is the essential precondition for keeping a correct posture of the body during adulthood, i.e. according to “the original hard-wired idea” or the genetic plan. If the development was disturbed in any way during this sensitive period, it is very probable that some disorder of the statics or dynamics of the musculoskeletal apparatus would appear in adolescence or adulthood. If the development was accomplished between fifteen and seventeen months of age, it would be obvious whether the musculoskeletal apparatus would be able to tolerate the stress, and eventually, which disorders could be expected to appear.

If the motor development was distorted during the first year of life, the following growth in adolescence would lead to further progression of these disorders. The following care is predominantly rehabilitative and orthopaedic. Luckily, there are only few of these cases in the population (3-5 %). More often, milder developmental disorders occur. Often, they aren’t obvious or they are considered irrelevant due to their supposed minuteness. Then, they aren’t properly treated. Consequently, the results aren’t perfect for the development of the musculoskeletal apparatus and subsequent ossification of the disorders. The disorders of the locomotive system are manifested in terms of “hardware”, i.e. the musculoskeletal apparatus, as well as the regulation of the locomotion of the body, i.e. the “software” disorder of the CNS.

← Illustration of the physiological ideal posture of the body in the standing position with presumed course of the muscle spirals.

5.1 Case Study – Hyperlordotic Posture and the Ventral Posture of the Pelvis (Risk of Development of Scoliosis even in the Case of Small Unevenness of the Pelvic Axes)

5.1.1 Illustration of the Developmental Complications and the Questions Connected with the Development of Spinal Scoliosis (Implementation of Technical Aids – Anti-Slip Mat and Elastic Bands)

Our treatment was recommended by an orthopaedist to the female patient due to incorrect posture of the body. The asthenic girl came accompanied by her mother that described her daughter’s problem as “incorrect stance”. She explained that she’d tried to convince the daughter to stand nicely. Otherwise, she would develop back pain or scoliosis. The problem stretched back to the time when she had started to walk and had worsened recently. It was obvious in the lateral view with a plumb line. They had attended various rehabilitative exercises without any relevant success. The daughter was physically gifted and her school results were good. The mother was mostly worried about the possible development of scoliosis. Both parents of the patient were tall and slim.

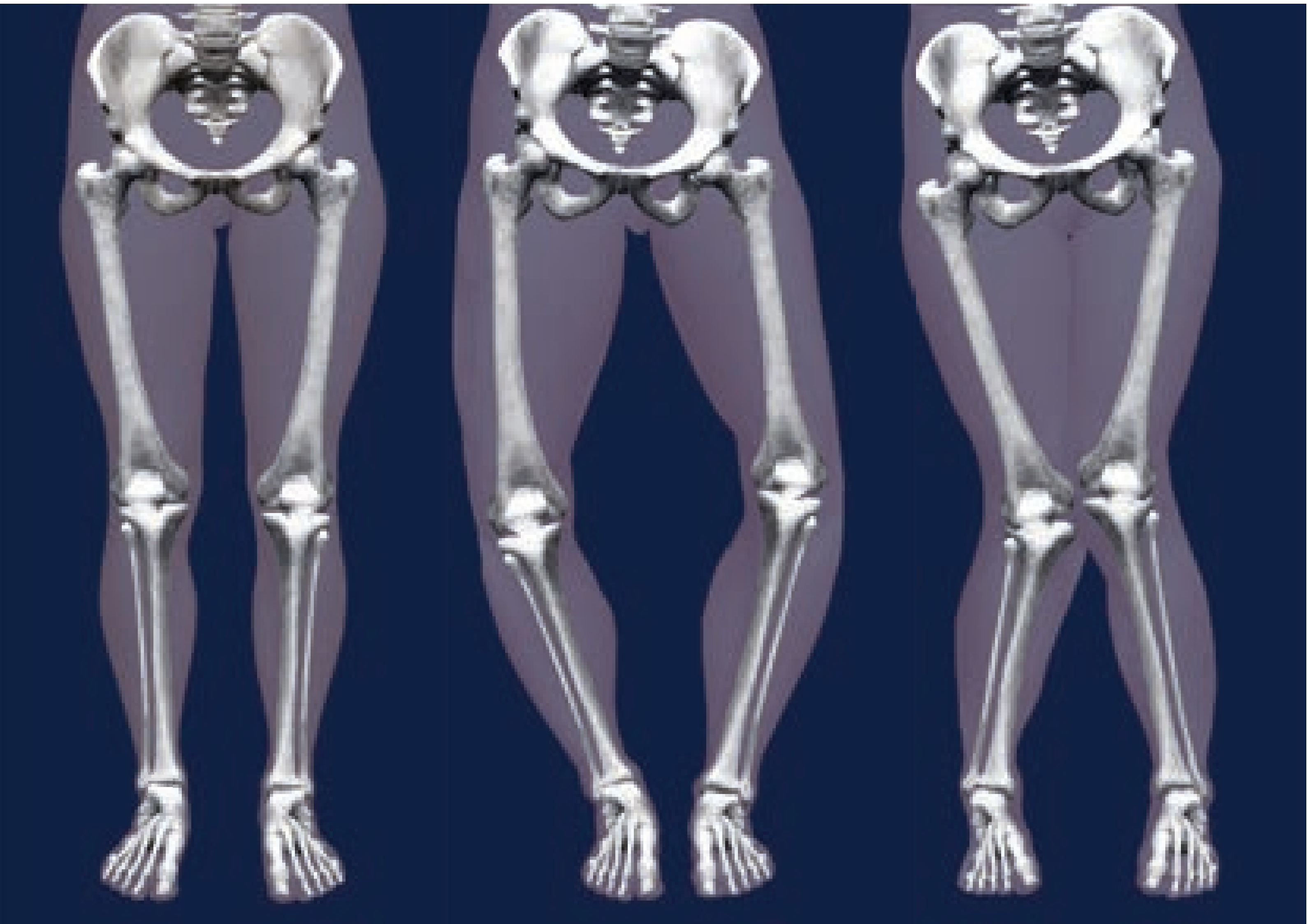
5.1.2
Description of the Problem (Clinical Findings)

The patient's history from the first year of life didn't show anything noteworthy. Only during the second year, impairment of the posture of the body occurred in terms of hyperlordotic posture of the lumbar spine reaching up to the middle parts of the thoracic spine. The rest of the thoracic spine was flattened and missed the kyphotic bending. The abdominal wall was arched and partially relaxed due to the ventral flection of the pelvis. The shoulder girdles protruded forward. Head posture and the posture and configuration of the lower limbs didn't show any clinical abnormalities.

5.1.3
Expert Explanation of the Problem

In terms of developmental kinesiology, this type of posture of the pelvis in flection is very probably caused by the persistence the so-called "new-born posture of the pelvis". This is a posture of the pelvis in the first flection period. This quite short period is very important within the developmental kinesiology and for the subsequent development of the posture of the pelvis. Flection posture of the pelvis persists during the three months after birth as a relic of the intrauterine period (refer to the section about kinesiology of the intrauterine life). Abandonment of this type of posture and the onset of the first extension posture after the third month of life provide conditions for future normal posture of the pelvis and the corresponding configuration of

The collapse of the arches of the feet, deviations of the axes of the calcanei, tarsal bones and digits

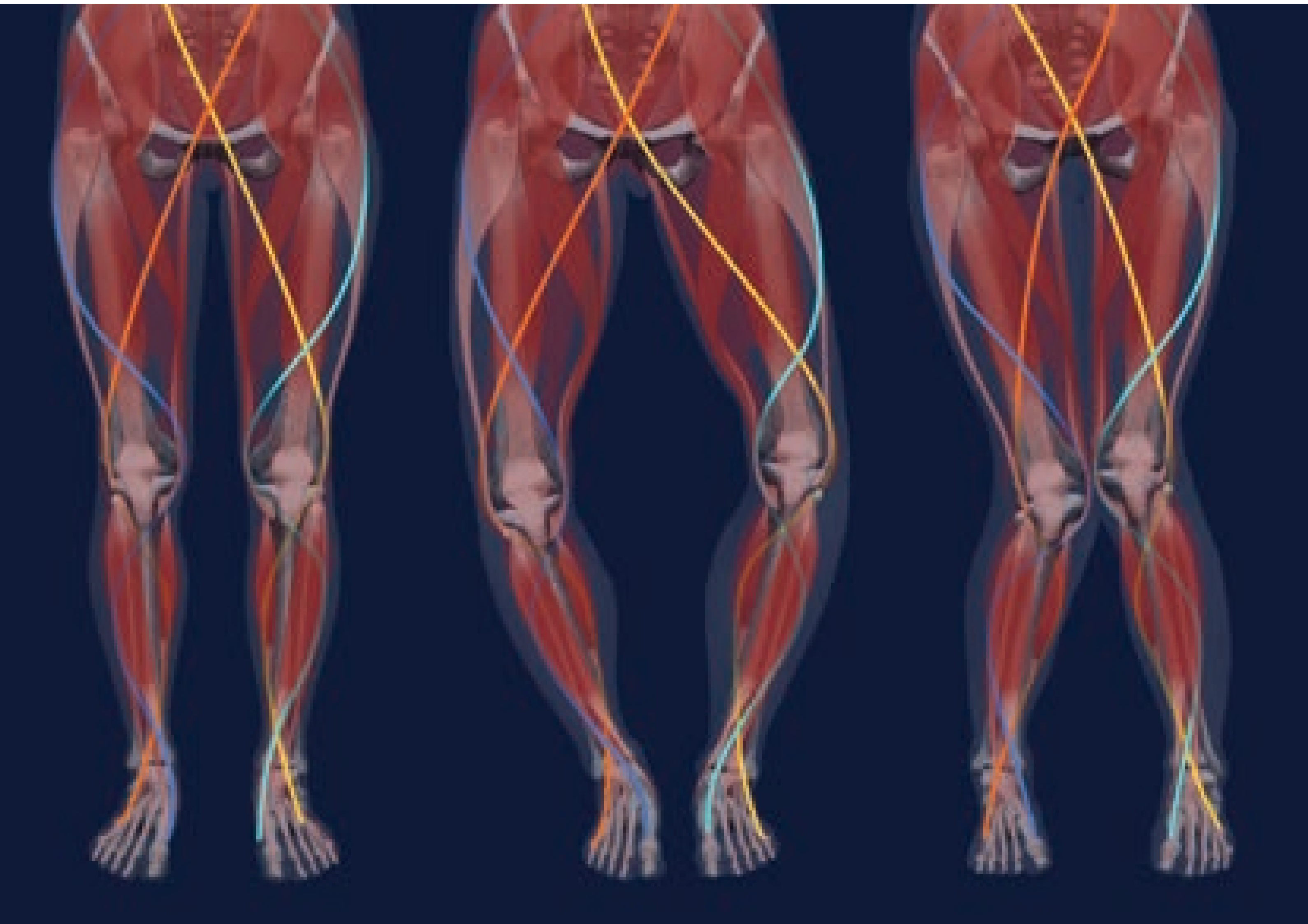


the curve of the lumbar lordosis, posture of the hip joints including their angular parameters and the geometry of the femoral cervix. Persistence of the flection posture of the pelvis adversely influences the development of the lumbar spine hyperlordosis. Concurrently, insufficient development of thoracic kyphosis occurs, and insufficient development of the thoracic kyphosis is the main restriction for the upcoming normal development of the rib-cage and the functionally related respiratory mechanics. On the other side, the ventral flection of the pelvis is manifested in the incorrect development of the hip joints in general as it restricts the correct centration of the head of the hip joint towards the acetabulum. Another severe developmental complication in terms of lateral deviation (hip joints stand in an uneven height) and axial rotation in the medial axis is the development of the symmetrical imbalance. Resulting deviation of the transversal pelvic axis towards the axis of the chest develops. This type of desaxation and lateral pelvic tilt are most probably the breaking point and original cause of the development of the scoliotic development of the spine. The following relative (functional) shortening of one lower limb is the remarkable facilitation of the development of the scoliosis.

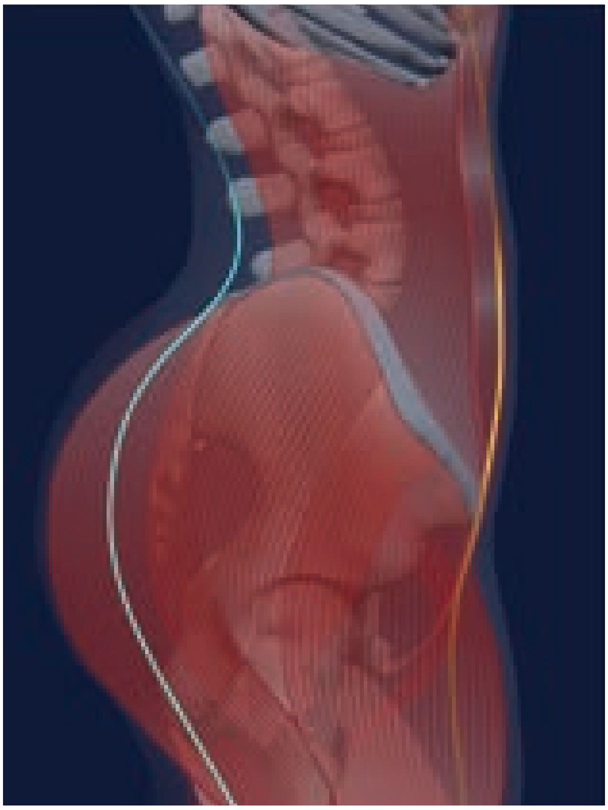
5.1.4 Illustration of the Solution

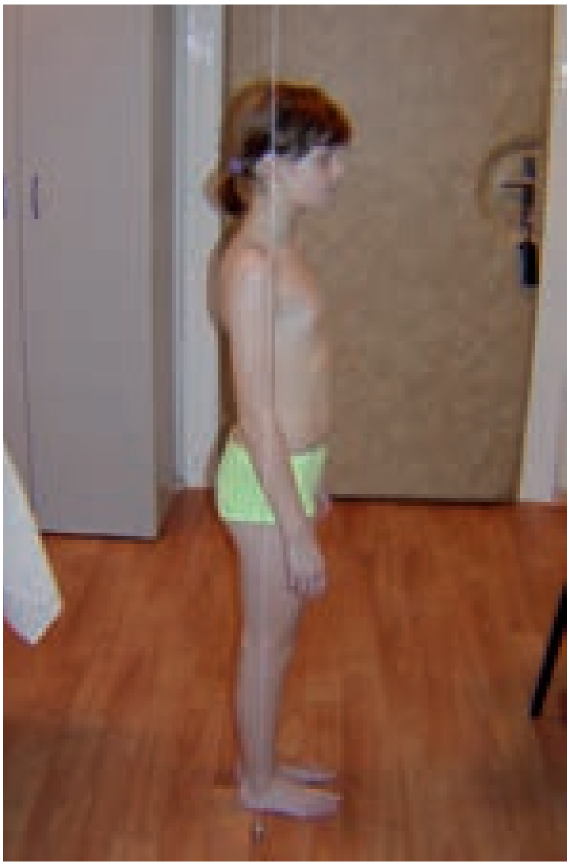
The patient and her mother regularly attended the therapeutic check-up visits, initially twice a month. After six months, we managed to fine-tune the therapeutic process and the visits were scheduled for once per month.

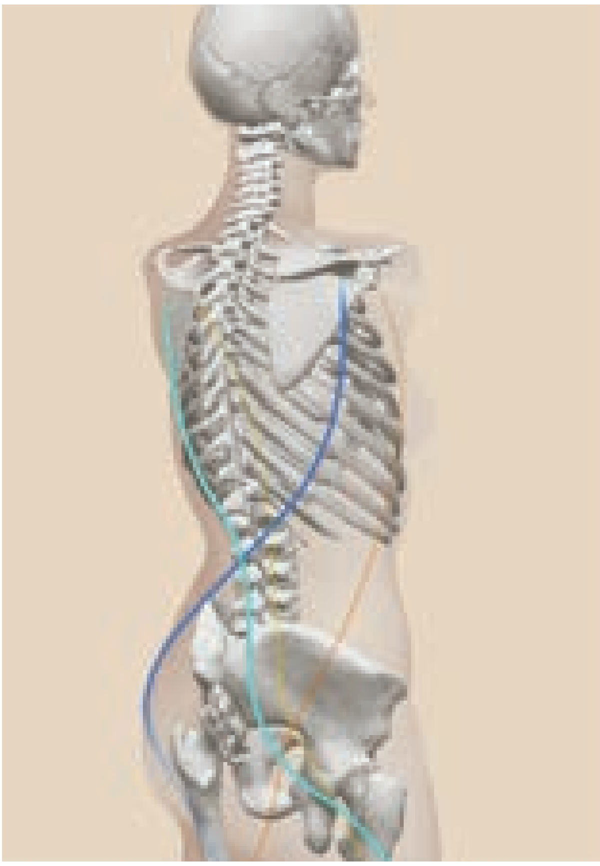
The collapse of the arches of the feet, deviations of the axes of the calcanei, tarsal bones and digits




Before the exercise using the Vojta method


Defective posture of the pelvis


After two years of intensive exercise


Physiological posture of the hips

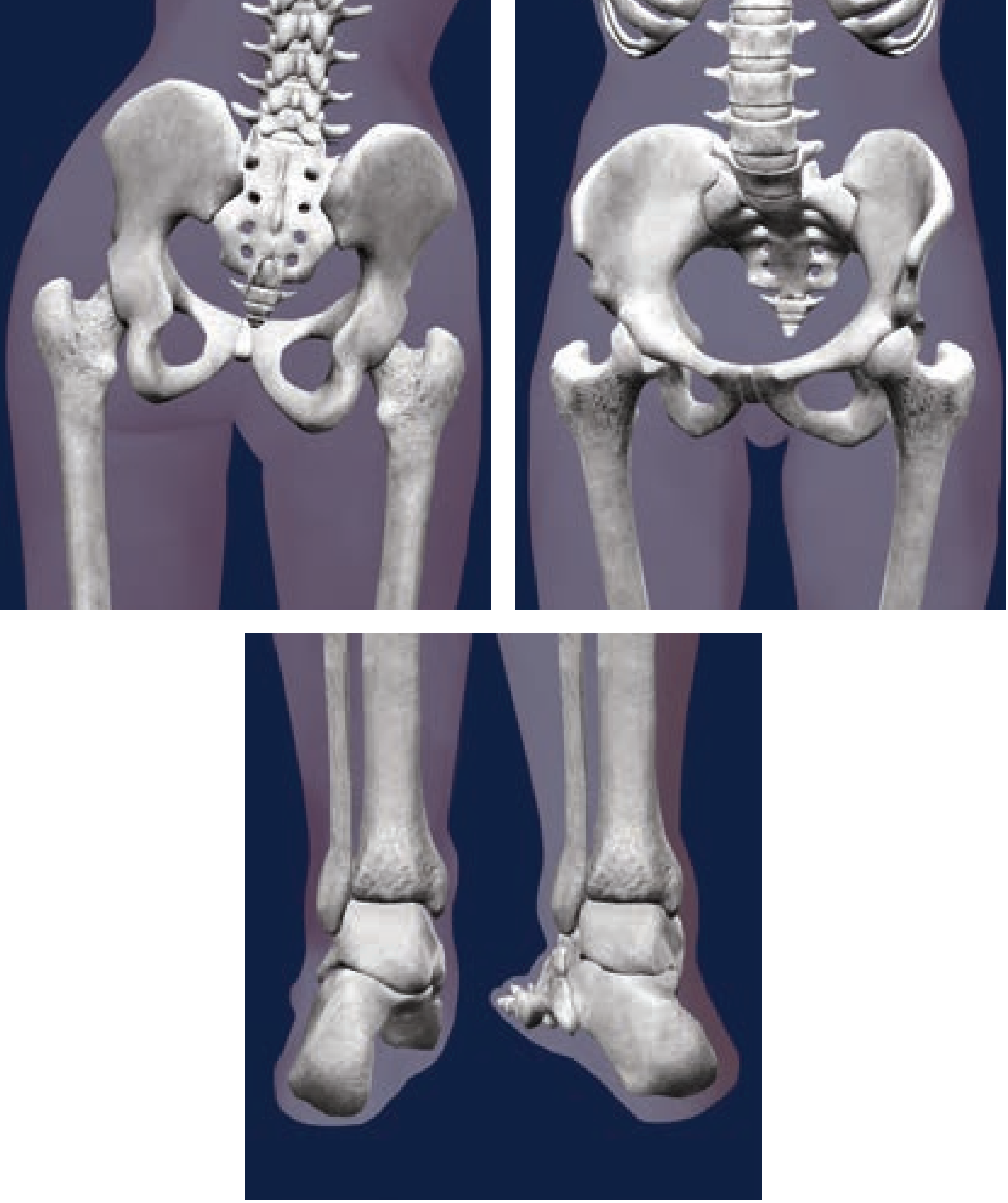
After training, the mother ceased attempting to straighten her daughter by providing warnings since such an endeavour is utterly useless. Initially, there was a complication with the use of balance discs as the patient couldn't tolerate them. She had considerable feelings of positional uncertainty, which wouldn't subside as is usual in the majority of cases. The solution was found in the use of anti-slip mats that improved the adhesion of the support surfaces of the body of the patient and improved her feeling of certainty. To increase the intensity of the stimulation, the elastic bands appeared to be useful. The therapy led to gradual improvement in the autonomic regulation of the posture of the body. The hyperlordotic bending of the lumbar spine resolved. Afterwards, the thoracic spine arched, too. The tilting of the pelvis practically normalised and the abdominal wall returned to its physiological position. The posture of both girdles also got into physiological posture in the axis of the body.

5.1.5
Explanation of the Solution

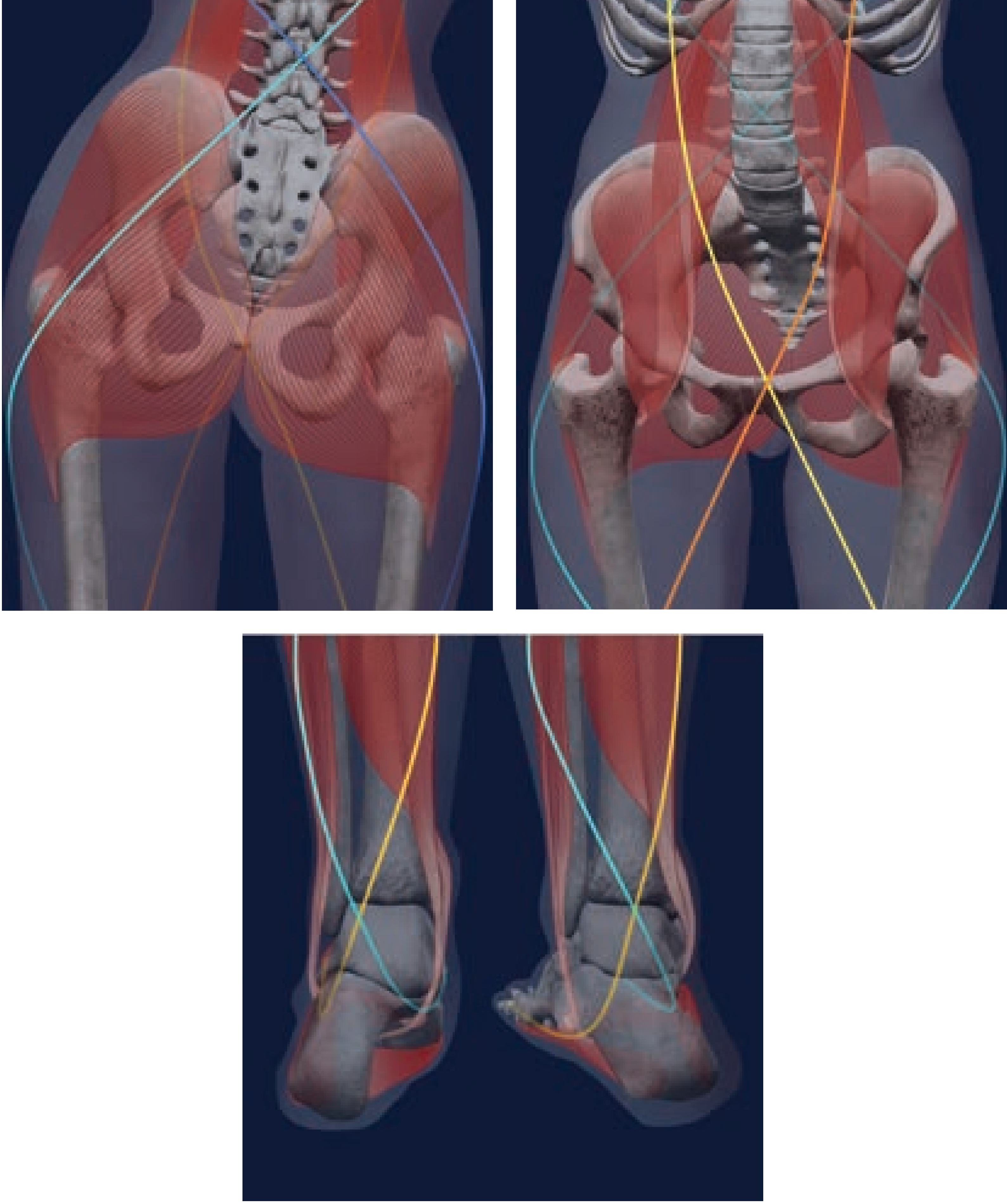
The normalisation of the status of the impaired autonomic regulation of the posture of the body required an approach to this patient that would respect her positional uncertainty. Finding the way to perform the reflex with soft and balanced manner allowed the sufficient intensity of the stimulation. We have enabled the coordinated involvement of both straight and oblique muscular chains. Due to asthenic appearance of the patient and low tolerance of the lability of the support surfaces and the centres of gravity of the limbs, the use of highly adhesive mats proved to be optimal. Elastic bands were properly used as well. It is possible to increase their pressure against the performed movement, and they increase the comfort of stability. Therefore, we rather used these elastic bands instead of weights, which would be used with most patients. The weights on limbs significantly shift the centre of gravity of the limbs. This leads to a gradual increase in stimulation and, simultaneously, the reflex effort in balance normalisation increases too. The general development of the locomotive apparatus of the patient practically normalised. Thus, it is highly improbable that scoliosis could appear during future development.

5.1.6
Specific View of the Problem with the Persistence of the Ventral Posture of the Pelvis in the Childhood and Adolescence

The development of the skeleton of the locomotive apparatus is directly dependent on the preconditions, to which it has been prepared during the first year of life. The smooth course of the basic part of the psychomotor development is probably the most important event for the proper development of the musculoskeletal apparatus. Persistence of the ventral flection of the pelvis supposedly represents the greatest risk factor for the future impaired posture of the body. Lumbar vertebrae perform their essential function, i.e. they transfer the forces between the chest and the pelvis (upper and lower motion potential – refer to section on 3D biomechanics), with great problems, if not positioned physiologically. This impaired posture is most probably responsible for several functional disorders of the lumbar spine, including intervertebral disc herniation of this part of the spine. Reverse normalisation of the autonomic regulation of the posture of the pelvis into the physiological posture involves a therapeutic



Deviation of the axes of the lower limbs



Deviation of the axes of the lower limbs approach, which is concentrated on the voluntary analytical strengthening and stretching of the partial muscle groups. This approach has little hope for long-term success. The origin of this impaired posture lies in the disturbance of the basic motion program formed during the important period of the first year of life. It's this period which we should therapeutically "re-approach", if we want to accomplish real improvements. This return could be practically implemented through reflex stimulation and the repair of the basic program of motor skills. Whatever went wrong during the first year of life, it must be repaired. The repair consists in two essential actions that work concurrently. The repair program is stimulated in a reflex way to restructure the basic program of motor skills (refer to the section on basic programs of motor skills). Along with the program repair, the musculoskeletal system itself is repaired as well. Only if the normalisation appears at the level of the program regulation of motor skills, could we expect the effect in terms of future good and smooth function of the locomotive apparatus. Then, the musculoskeletal apparatus would be able to endure the long-term exertion with physiological response and adequate time for regeneration.

5.1.7
Disorders of the musculoskeletal apparatus are apparent in the defective posture of the body on all levels, and in the regulation of the basic stereotypical movements:

It is apparent in:

- The collapse of the arches of the feet, deviations of the axes of the calcanei, tarsal bones and digits
- Deviation of the axes of the lower limbs.
- Defective posture of the pelvis
- Impaired posture of the axes of the spine

Lateral view of the pathological foot and toe posture

- Disturbed configuration of the ribcage
- Pathological posture of the shoulder girdles
- Abnormal axes of the upper limbs and hand in particular
- Impaired posture of the head
- Impaired posture of the mandible
- Abnormal axes of the eye bulbs
- Collapse of the arches of the feet, deviations of axes of the calcanei, tarsal bones and digits
- Deviation from the axes of the lower limbs

5.2 General Kinesiology of Adults

Disorder of the kinesiology of the adults in terms of software impairment is most apparent in the pathology of the stereotypical movements:

- Gait
- Grasp
- Respiratory movements
- Stereotypical movements of the orofacial region, sucking, swallowing, speaking

Anterior view of the pathological foot and toe posture

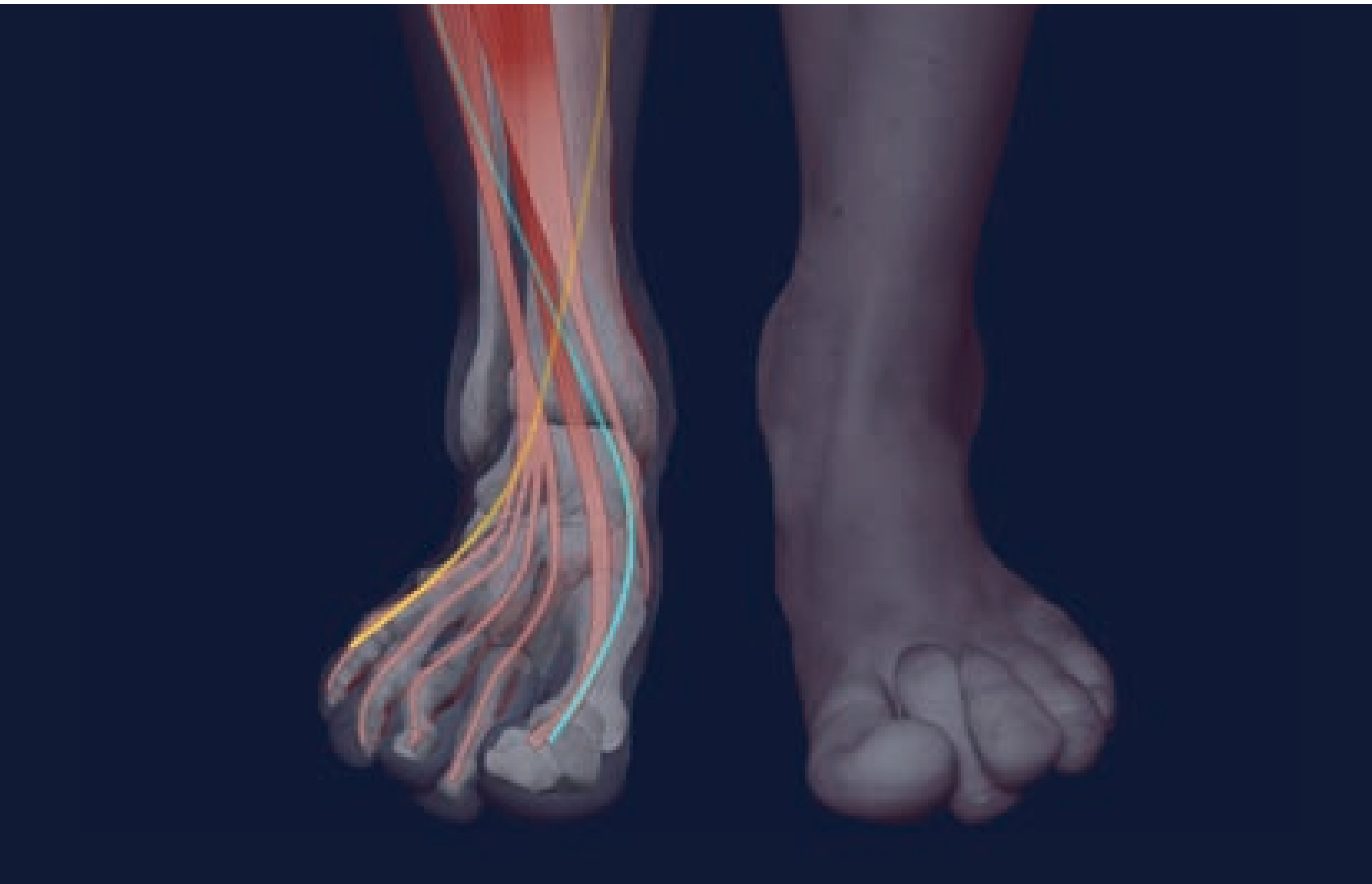
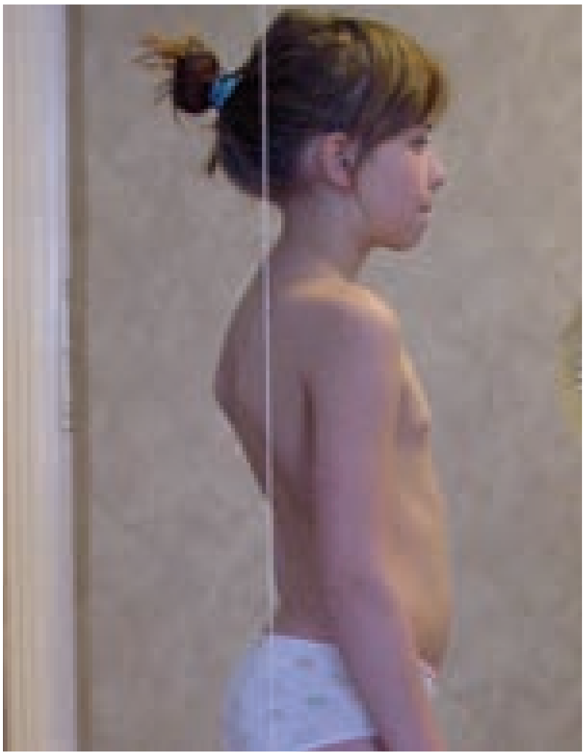
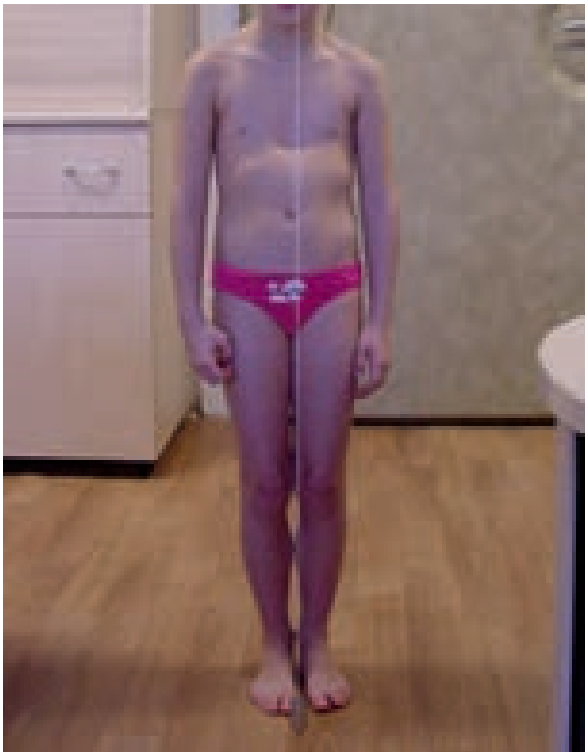


 Illustration of the pathological posture of the fingers of the right hand with ulnar deviation

Illustration of the pathological posture of the fingers of the right hand with ulnar deviation



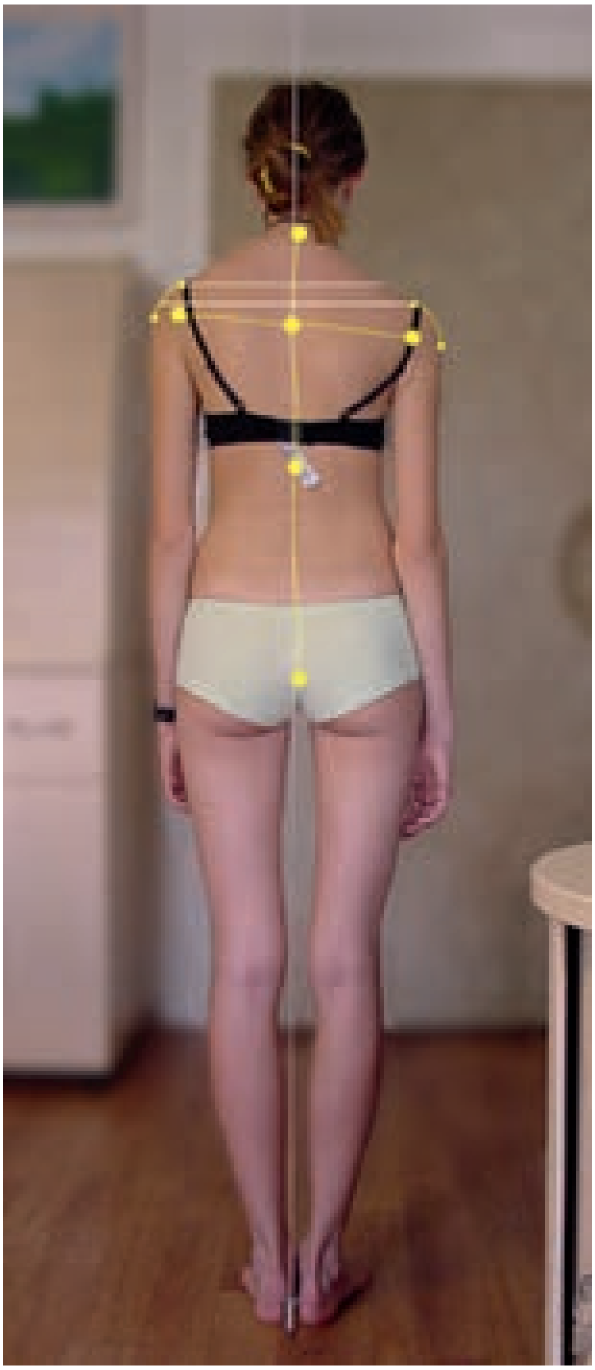
Impaired posture of the body, ventral flection of pelvis, hyperlordosis of the lumbar spine, relaxed tone of the abdominal wall muscles, ventral posture of the shoulder girdles, protracted posture of the head



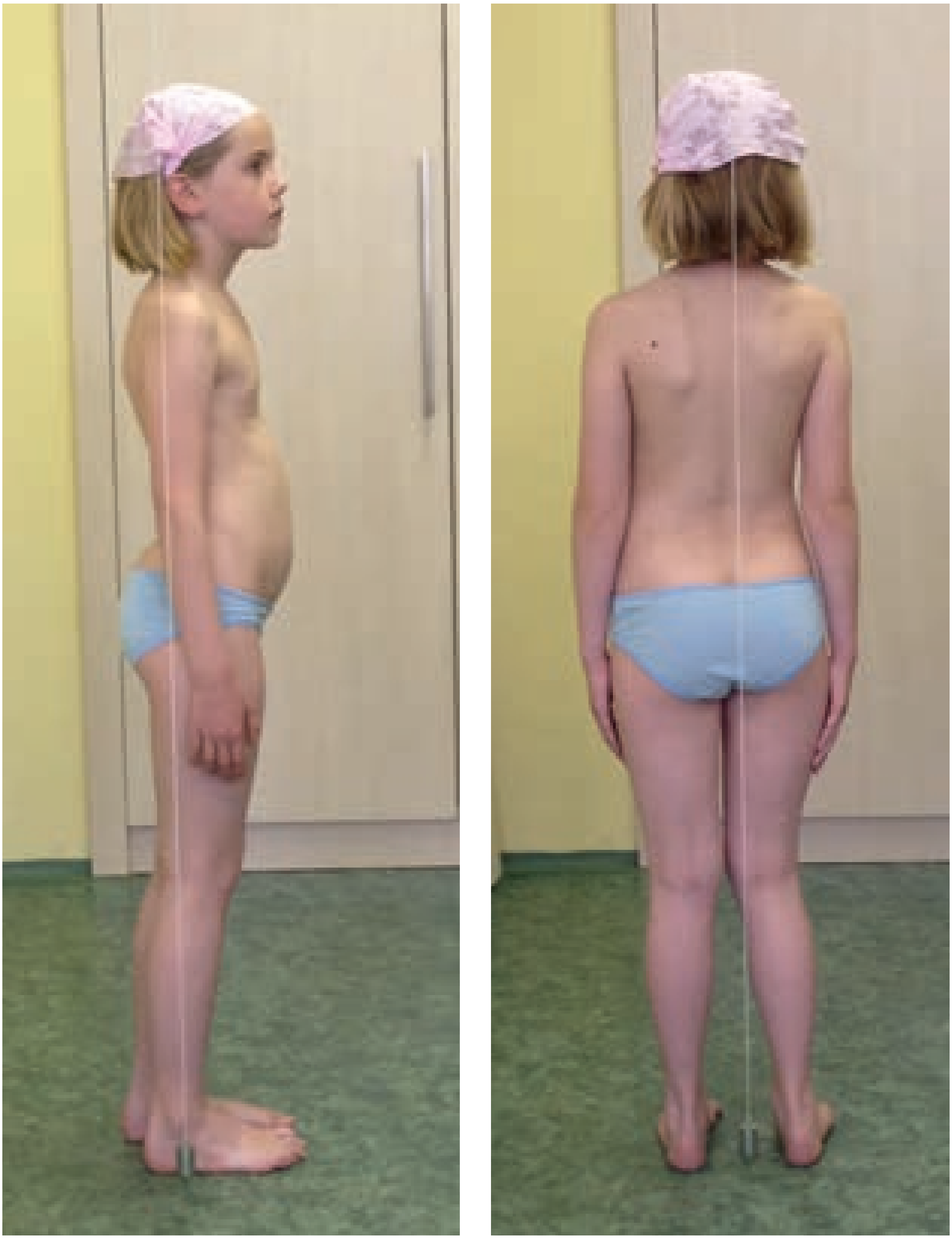
Impaired posture of the body, ventral flection of pelvis, hyperlordosis of the lumbar spine, relaxed tone of the abdominal wall muscles, ventral posture of the shoulder girdles, protracted posture of the head

← Impaired posture of the body, relaxed tone of the abdominal wall muscles, dilated inferior aperture of the ribs, impaction of the sternum and the collapse of the chest, ventral posture of both shoulders

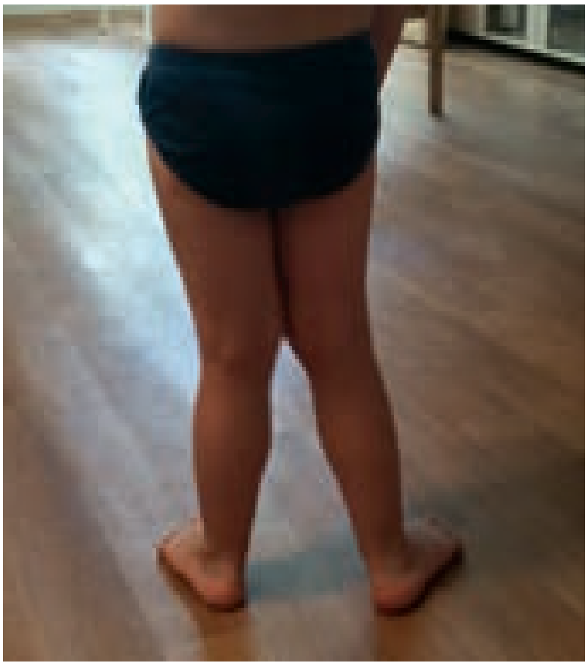
Impaired posture of the axes of the spine
Disturbed configuration of the ribcage



Impaired posture of the right shoulder girdle in protraction and depression

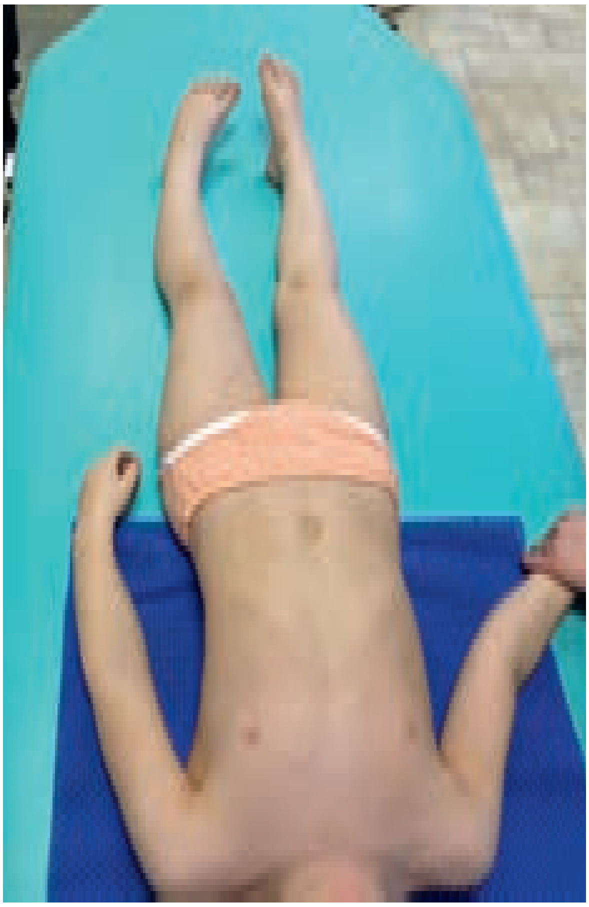


Generally impaired posture of the body; medial axis of the right calcaneus, axis of the right knee joint going inward; oblique posture of the pelvis and axillar rotation of the pelvic axis – right hip is rotated ventrally; incipient scoliotic posture of the spine; hyperlordosis of the lumbar spine reaching the lower thoracic part of the spine; relaxed tone of the abdominal wall muscles; ventral posture of both shoulder girdles.

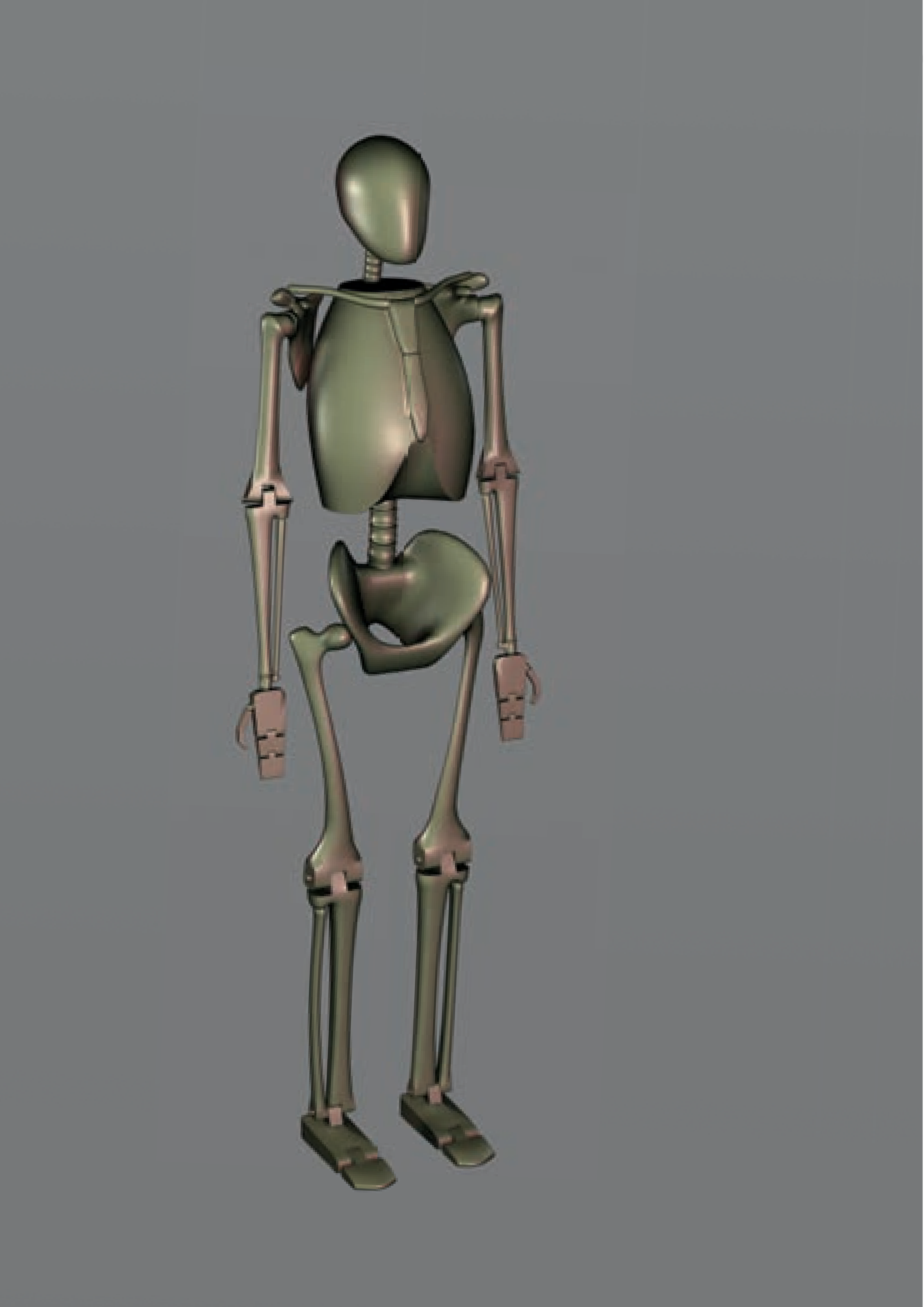


Impaired posture of both legs; both knee joints in valgus posture; deviated posture of calcanei of both feet

Detailed image of the pathological posture of both axes of calcanei, including the collapse of the transverse arches of both feet



Impaired autonomic regulation of the posture of the left leg in the supine position in relaxed state; the limb is rotated inward in the hip and ankle joints



6. Theoretical Part – VM2G

6.1 View of Human Motion in Terms of

- Geometry
- Mechanics
- Biomechanics
- Anatomy
- Neurophysiology

> *"Only the type of certainty derived from the cooperation of mathematics and empiricism allows us to talk about science." Professor Joseph Ratzinger – Pope Benedict XVI*

The aim of this chapter is to provide the view of the human locomotion from atypical standpoints. Current textbooks of biomechanics and anatomy describe the locomotion of the human body in the case of a fully-developed adult individual. I think, the fundamental principles of locomotion of the human body are based on the early developmental phase in the first year of life. This period is extremely intensive in many aspects. It is particularly essential for the future life and for building good fundamentals of locomotion that would become unchangeable in the older age.

For a deeper understanding, it is necessary to view the locomotion of the human body from the perspective of geometry followed by mechanics and, at the higher level, biomechanics. Anatomy then forms the basis of an even higher perspective. Finally, after passing through these stages it is possible to perceive movement regulation – i.e. the neurophysiology.

6.2 Fundamental Facts about the Geometry of Human Locomotion

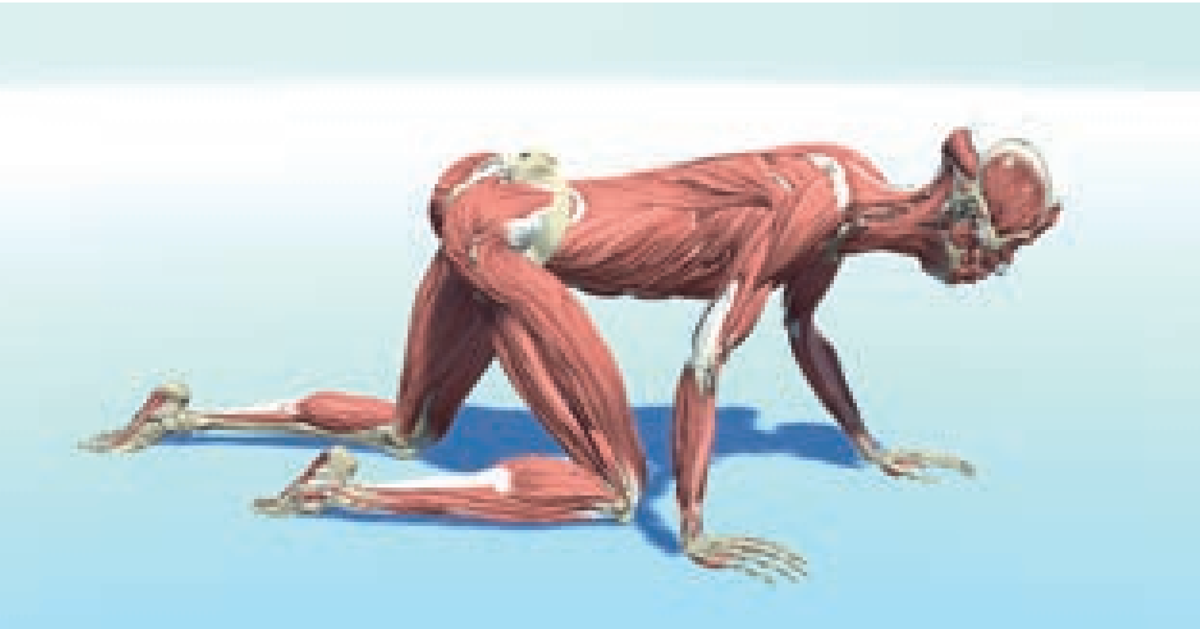
- Supporting points, supporting lines and supporting surfaces
- Points of motion and their vectors
- Centre of gravity of the body, the head and the limbs
- Forces, chains of forces and their vectors

> *"God is a geometer and it is necessary to search the way from chaos to unravel the order." – Plato*

Performance of any movement imposes necessary conditions of creating the points of support for the object and points that move together with the object. If we thought of the locomotive apparatus of the man from this point of view, we would also find the point that would serve as support and points that would serve as locomotion.

Similarly to physics, we can find the precondition of symmetry in the mechanics of the locomotion of the human body, too. Symmetry is important because it plays a significant role during the creation of stable systems with

Animation development of locomotion in the adult body



Interactive development of locomotion
bit.ly/2n5A2eL

minimal concurrent energy requirements. Symmetry imposes many rigid restrictions, but on the other hand, it is extremely useful as it removes redundancies from the system.

From a clinical point of view, deviations from symmetry lead to gradual decentralisation of joint surfaces, shifts in axial settings of the joints, blockages of the joints, herniations of, e.g., intervertebral discs and to

Animation development of locomotion in the adult body

Interactive development of locomotion
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degenerative changes due to incorrect load on joint cartilages.

Maintenance of joint symmetry in resting positions and in motion is the goal of autonomic regulation. From the outside, it is practically impossible to achieve the permanent recovery and normalisation of the symmetry itself by an analytical intervention. Symmetry completely depends on the complex system of regulation of muscle tone, regulation of righting and postural reflexes, autonomic regulation of the posture of the body and autonomic regulation of the basic stereotypical movements.

Symmetry as the fundamental precondition of locomotion enables muscular functional changes, “metamorphoses” within the system of stereotypical movements.

The general symmetry of the human body is extremely complex. It is provided by spirally organised muscular kinematic chains. There are two types of chain connections: right-to-left and left-to-right spiral chains. Concurrently, the chains are cranio-caudal and caudo-cranial. In terms of force mechanics and velocity, the chains could be divided into two types. Fast chains have a steep spiral. They are primarily intended to follow fast motion. The slow, power chains have shallow spirals and are intended for tensile exertion.

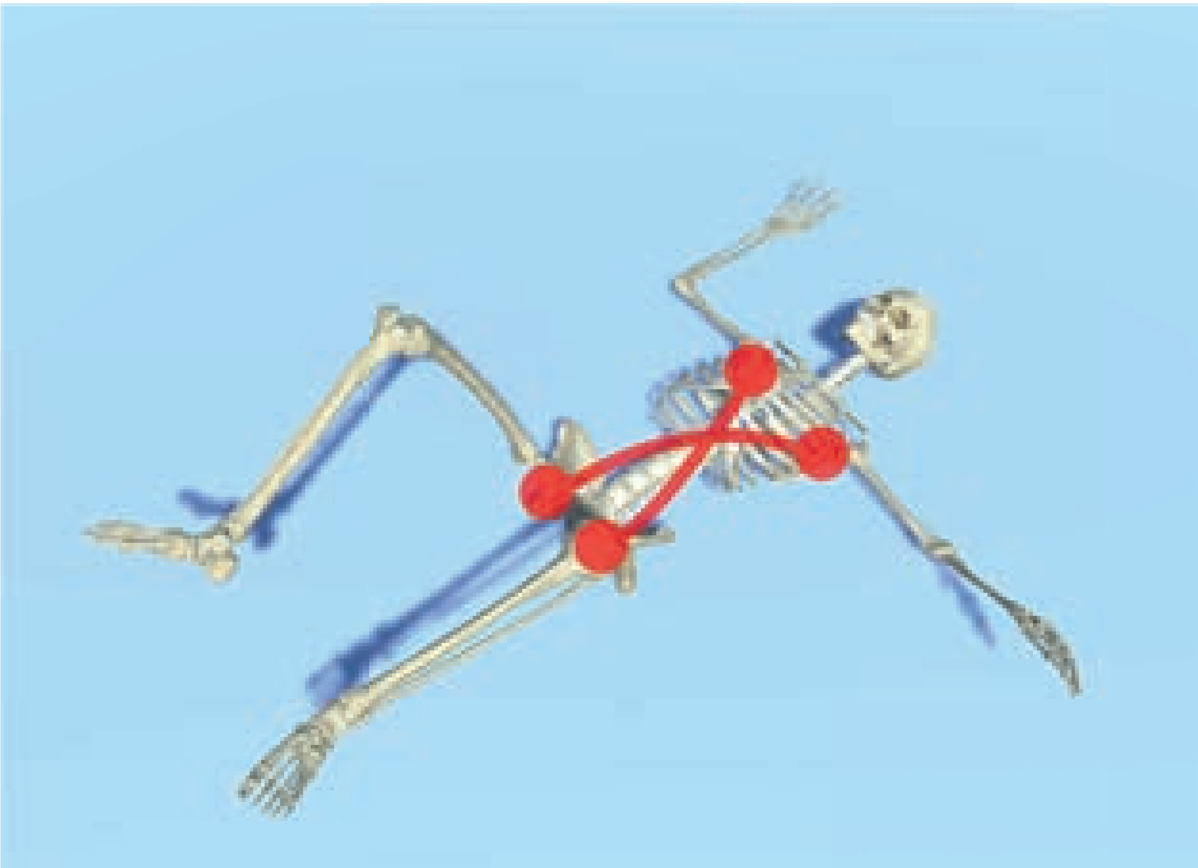
6.3 Supporting Points, Supporting Lines and Supporting Surfaces

The development of motor skills is heading towards a gradual decrease in supporting surfaces down to supporting lines and supporting points.

A supporting surface is largest in a child after birth and it becomes even larger in the case of early developmental impairment. Concurrently, the centre of gravity is situated low in accordance with the width. This also applies conversely. The more the supporting surfaces diminish into supporting points, the higher and more labile the centre of gravity is situated.

Clinically, the enlargement of the supporting surface can be observed during the reaction of the reflex of Moro. The child abruptly extends both hands out to enlarge

Body in the supine position – centre of gravity inside



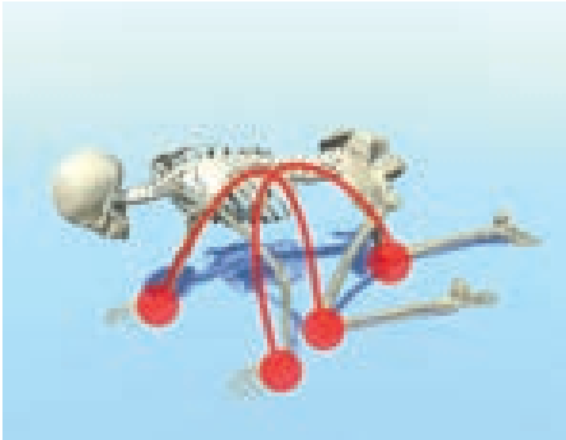
its supporting surface and the positional certainty that was disturbed by the stimulus.

Basically, there are two types of supporting surfaces: the stable ones with at least four supporting points and labile ones with three supporting points.

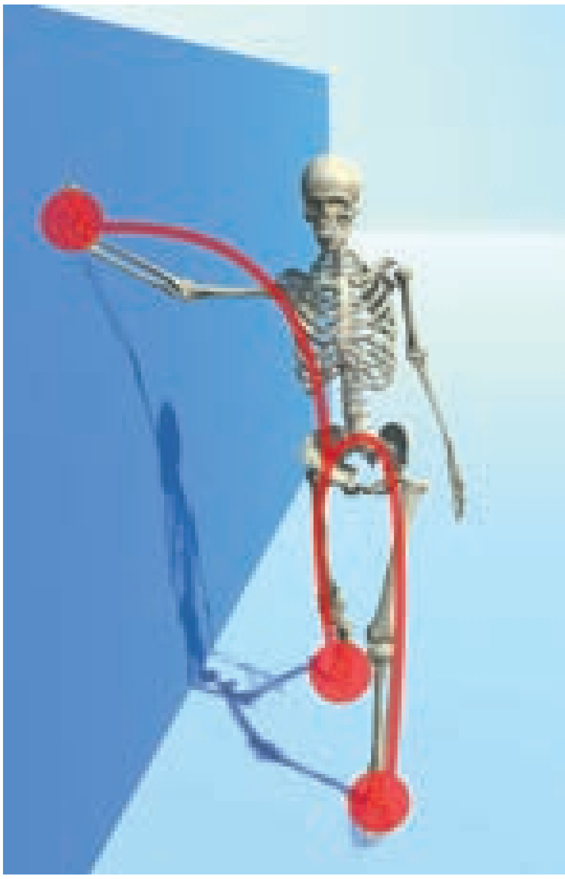
If the supporting surface were stable, the centre of gravity would be inside of this surface almost every time. Under normal circumstances, the stable surface can't enable the locomotion of the body.

Three supporting points become a necessary precondition for movement. The elevation of the body's centre of gravity and the limbs enables the points of motion to divert these centres of gravity from the supporting base. The centres of gravity have so far stayed inside the supporting surface. Hence, the body has been stable. The centres of gravity shift out of this inner space of support. The supporting surface diminishes to two supporting points, creating the supporting line. Bordered by two points, the supporting line is very labile. It allows the simple shift of the

Support on four points –
centre of gravity inside the supports



Position of the centre of gravity
of the lying body and its shift in the turning body
(formation of a curve)



Support on two points in a line –
centre of gravity outside support

centres of gravity to a new position. This forms the basis of the movement.

The more the supporting base diminishes, the more the centre of gravity of the body is elevated into the space. This increases the overall lability of the body. Alternation of the stable and labile supporting bases is fundamental for the implementation of the movement. This alternation of supporting sectors is related to the phase shift of the centre of gravity within the space in terms of an increase in the lability of the centre of gravity against its stable position.

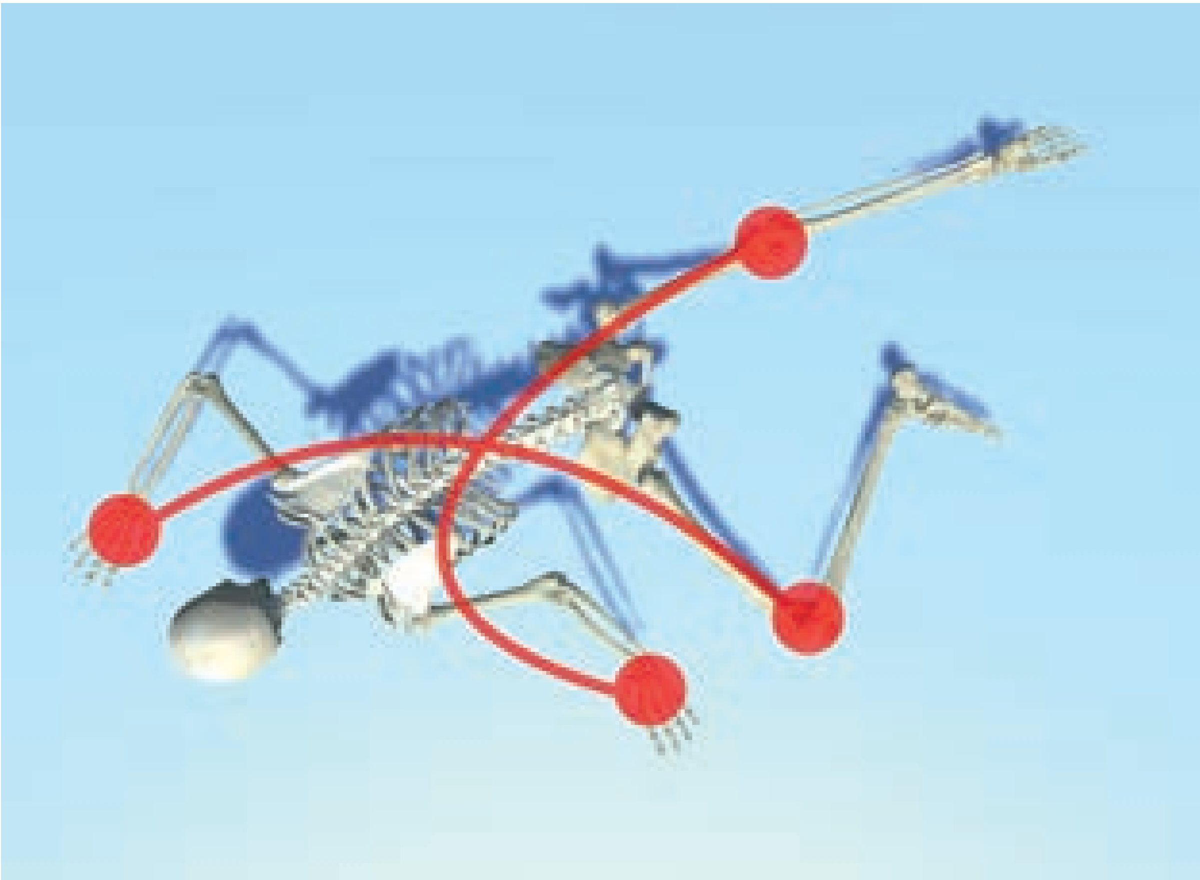
"Structurally", this secures the ability of the body to offer to the centre of gravity compensation for its deviations. These deviations are also created at rest, but they are even more remarkable in motion. Their compensation is implemented in three basic spatial planes.

6.4 Points of Motion and Their Vectors

The situation concerning the compensations of the deviations from the centre of gravity becomes even more complex in motion. The deviations acquire an asymmetrical quality because the body is situated in the movement trajectory in three-dimensional space. During the compensation of the deviation, the kinetic energy of the axial organ and limbs, acceleration and deceleration of the movement of the very body, the extent of adhesion of the surface of support of the moving limb and many other factors must be "included".

These complicated calculations of regulation of the equilibrium and maintenance of the symmetry of the motion happen naturally. It is possible to interfere with this action only

Belly-crawling – centre of gravity inside the support



Video

New-born reflexes

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marginally and for a short period. Only in individuals, who have undergone specific training, the ability of active interference with the course and regulation of the autonomic regulation of the movement could be observed, e.g., in ballerinas. This ability gradually diminishes after cessation of the training and the regulation falls under "the rule" of the autonomic programs.

During human motor development, the programs of automated stereotypical movements go through their genetically predetermined process. In the period of developing an upright stance, from birth to about 1.5 years of age, programs determined for the ability of the body to move in the environment with gravity are being "unpacked and loaded".

The gravity wasn't perceived by the child during the prenatal period. Thus, the program couldn't be initiated.

Concurrently with the maturation of the basic righting, antigravity and balancing stereotypes, the basic stereotypical movements are initiated, e.g., stepping or grasping stereotypical movements. These antigravity programs and basic stereotypical movements mature with the body and are completed when full physical maturity is reached. Practically, the important autonomic programs of locomotion are completed concurrently with maturation of the physical constitution. In this period, and shortly afterwards, the best results in sports could be observed since the gross motor skills play the main role in the sport activities.

Middle age usually allows noncomplicated implementation of the motor programs and the musculoskeletal system. This relates to the necessary care of the next generation. If the programs were loaded inaccurately in the first year of life, the first severe impairments of the locomotive apparatus would start to appear.

Disturbances of the posture, righting, balancing and anti-gravity mechanisms and also related disturbances of the basic movement stereotypes formed and ossified. For example, intervertebral disc herniation is among the most common pathologies.

In later life, the disturbances of the locomotive apparatus related to premature degenerative processes of the joint cartilages start to play a part. They are also caused by the incorrect program regulation and subsequent erroneous physical growth. In all likelihood, these errors not only add on to each other, they in fact multiply each other. Due to the influence of its increasing entropy, the regulation of the locomotive apparatus generally degenerates. It is manifested at the level of increasingly inaccurate regulation and in progression of the degenerative processes of the joint cartilages, decrease in density of the bone matrix, reduction of elasticity of ligaments and joint capsules and atrophy and shortening of the muscular mass. These biomechanically unfavourable parameters constitute the common cause of falls and subsequent bone fractures and other serious injuries among the elderly.

6.5 The Centre of Gravity of the Body, the Head and the Limbs

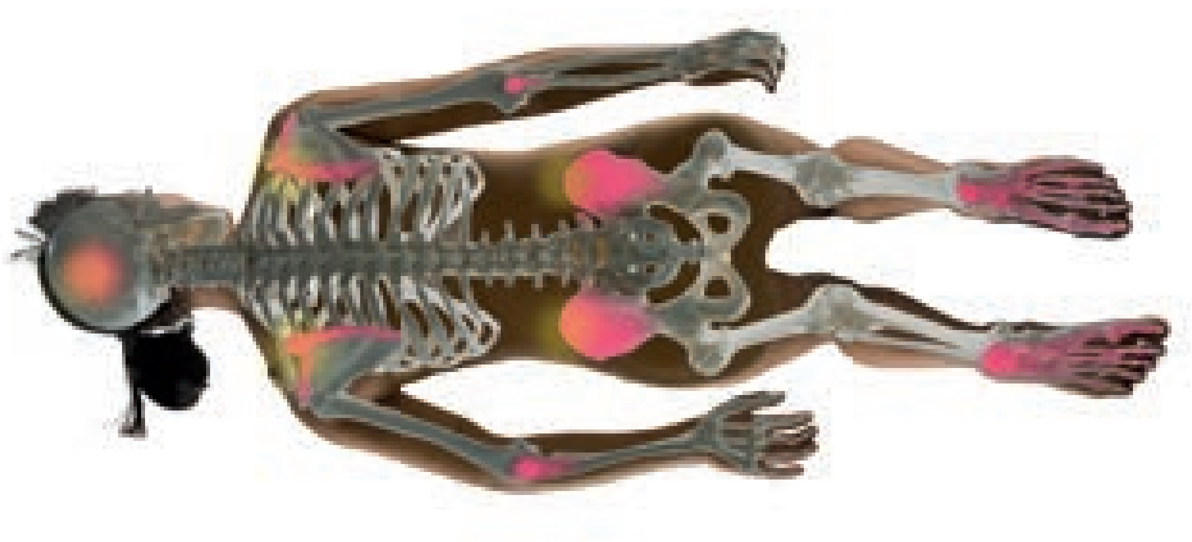
6.5.1 Kinematic Mechanism

Kinematic mechanism represents another view of the function of the musculoskeletal apparatus of the human body. It's extremely complex. Perhaps, it's the most complex moving phenomenon on earth in terms of kinematics. The complexity is not an end in itself. It originates in the purpose, to which this mechanism has been "constructed". Unlike various unhuman apparatuses for locomotion, the human body has been equipped with abilities of extraordinarily variable activities. The setting of fine motor skills is utterly unique. The essence of the excellent variability and faculty of fine motor skills of the hand and orofacial region consists of extremely complex regulation programs. Their growth and "program installation" takes a very long time, from a year to a year and a half. Due to this complexity and long complicated "installation", the programs are concurrently very fragile and prone to damage. The damage could occur in utero, during delivery and during the whole development, i.e. up to a year and a half.

6.6 Muscular Forces, Chains of Forces and Their Vectors

Muscular forces generated by the locomotive apparatus, the way they're still comprehended,

Illustration of the body in the supine position (view from below) with indicated supporting points at the occiput, scapular margins, elbows, pelvic alae and soles



would not allow the performance of basic locomotion or more complex kinetic functions. Normal motor development in the first year would not go through its milestones – the turning, the belly-crawling, the crawling on all fours and the standing upright.

The current view of the executive organ of motor force, i.e., the muscle, is quite reductive and compares its function to that of a piston in a rod. It only enables pulling in one direction or relaxation of the pulling in the opposite direction. This one-dimensional image of muscular function constitutes the basics for the examination of muscular strength according to muscular tests. Muscle functions are comprehended in isolation and analytically. The muscles are described anatomically by their beginnings and insertions, while the beginnings of the muscles had their paths decidedly set on the torso.

In this analytical model, the resulting movement the muscle can perform is planar. Thus, it is how the muscle is examined during the muscle test. This simplified image is further implicated into the practical approach to the musculoskeletal apparatus in training or rehabilitative care.

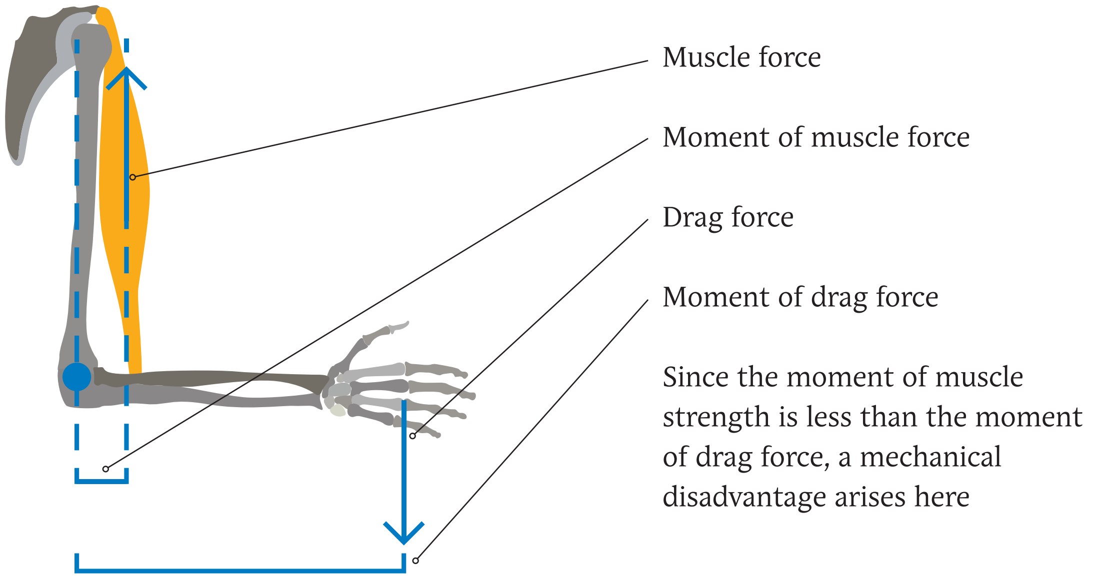
6.7 Muscular Chains of Forces and Their Vectors

To perform basic stereotypical movements and the "overlying" complex kinetic creations, the human locomotive apparatus needs much more complex force mechanisms. One-dimensional muscular levers wouldn't be able to move it. The kinematic mechanism of the locomotive apparatus is "powered" by a complex and extremely spatially-complicated set of force vectors. The effective mechanisms that generate these force vectors are muscular chains. Because of their extraordinary complexity, and because they haven't complied with the established analytical anatomy of the locomotive apparatus, their existing description is quite imperfect.

Muscular chains wrap the skeleton in spiral loops and run inside through it. The loops cross each other on multiple levels. Muscular chains are significantly functionally and anatomically interconnected. (Myers 2014) [7]

7 MYERS, Tom. Anatomy Trains – Third Edition. Elsevier 2014. ISBN 978-0-7020-4654-4

Illustration of the running body; supporting points at the heel and the heads of 1st and 5th metatarsi are indicated



Mechanical advantage of a muscle and moment of force

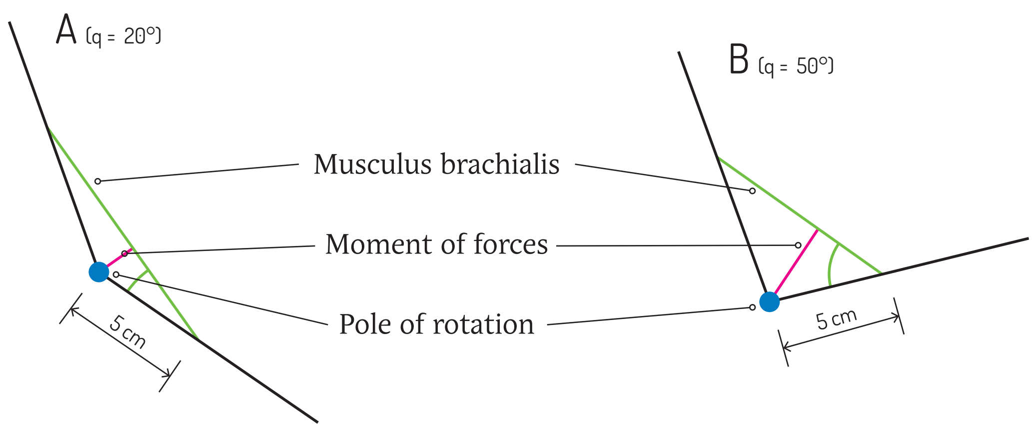
Force vectors generated by muscular loops are very complex and they exhibit spatial spiral trajectories. The system is extremely complicated and the possibility to measure it through a muscle test or similar tools is totally impossible.

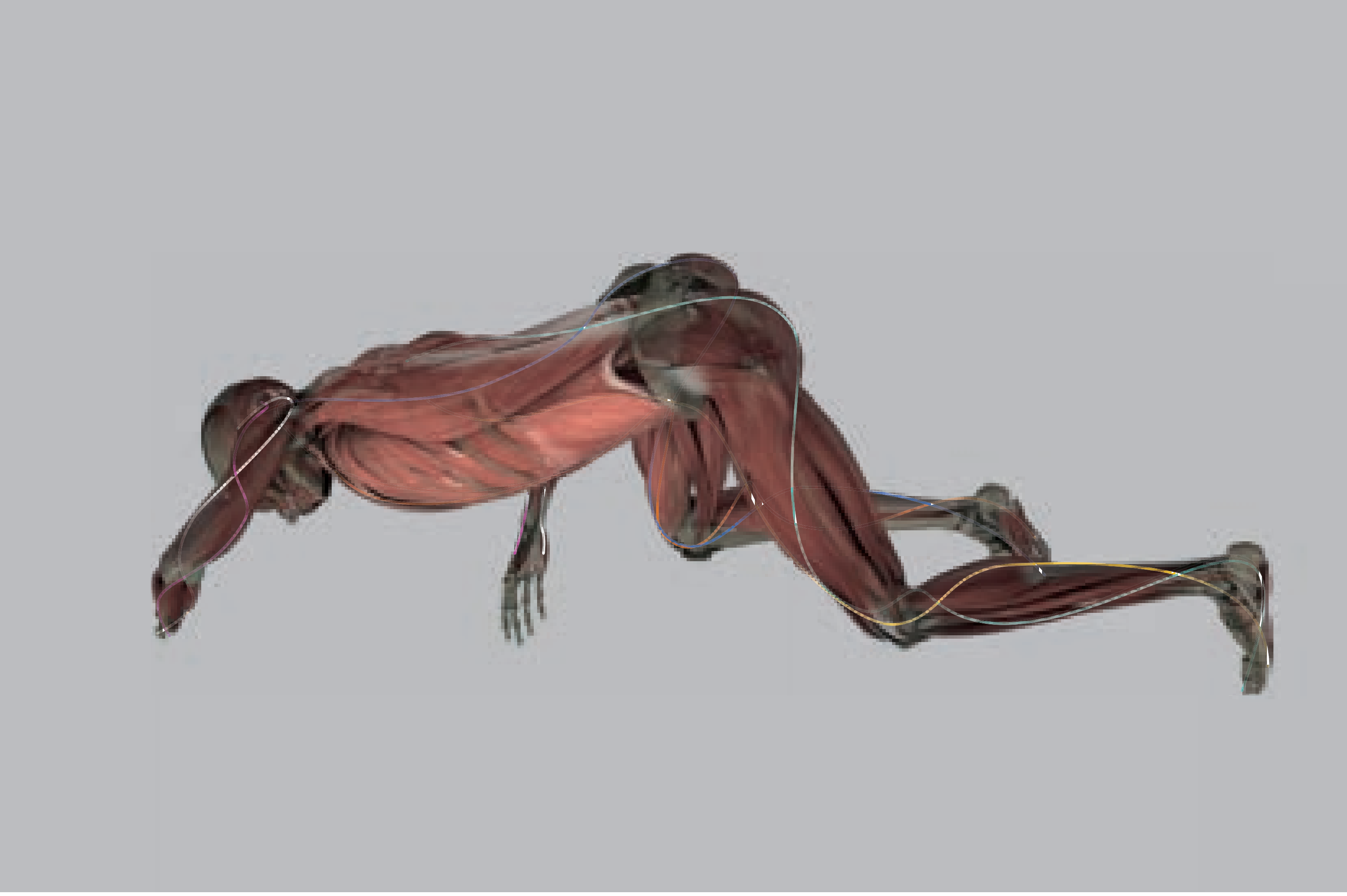
Functional connections of muscular chains take place as soon as the intrauterine developmental period (Langmeier, 2006).[8] Muscular chains responsible for the connection of basic antigravity and righting functions, and the functions of the basic stereotypical movements spring into action during the first year of life after birth. **Interventions within this motor and neurophysiological maturation are highly undesirable, except in cases of necessary therapeutic interventions due to the necessary repair of the impaired motor development.**

8 LANGMEIER, Josef. Vývojová psychologie. Praha: Grada 2006. ISBN 80-427-1284-9

6.8
2D – Functional Anatomy

The existing view of the locomotive apparatus is strongly reductionist. It is based on an anatomical view that originated in the 16th century in accordance with the descriptions of the anatomist A. Vesalius. This concept is only two-dimensional. It was useful for practical surgical and later orthopaedic interventions into the musculoskeletal apparatus. It was





Muscle spirals in the locomotive function, worm's eye view of a body lying on its side

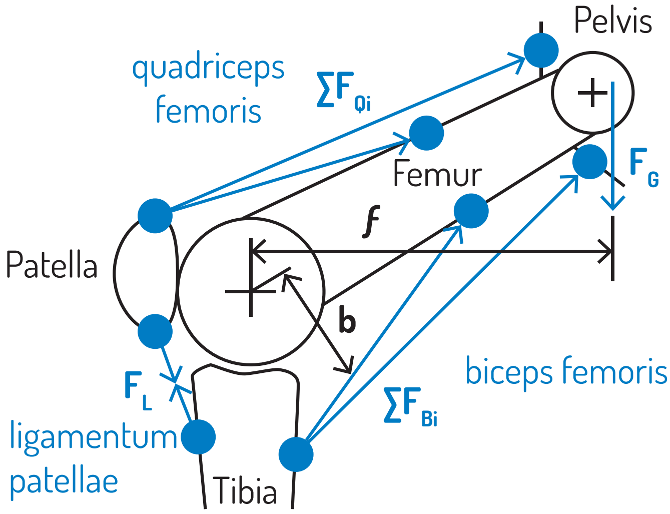
utterly sufficient for these purposes and the reduction of the muscular activity to a formula: *origin + insertion = function* wasn't detrimental.

Gradual increase in demands on the locomotive apparatus, for example, widening and intensification of sport activities, forces more training and methodological approaches. They ought to improve the general condition and the kinetic abilities. They are also related to therapeutic interventions on the overloaded and overtly worn-out and increasingly injured musculoskeletal apparatus. Thus, all these training rules and methods, performance or leisure sport activities, fitness and the subsequent therapeutic intervention on the musculoskeletal apparatus are based on a 2D anatomical concept, which is remarkably simplified, analytical in nature and intended for completely different "treatment" with the musculoskeletal apparatus.

These anatomical basics can't be useful for other requirements. Other specialties have also been evolving on this 2D anatomical model: biomechanics, kinesiology, sports medicine, etc. The limited view of the 2D anatomy is being expressed by an increase in, and multiplication of, this essential "error" in several scientific specialties and the methodologies of sport trainings etc.

The analytical view is based on the presumption that the muscles in the living human body act in accordance with the parameters "origin, insertion, function" that were attributed by the anatomical description of the corpse. It follows that muscles must be trained the way the anatomists have "constituted" them. Unfortunately, it has been without respect for the real functions of these muscles within the biomechanics of the whole musculoskeletal apparatus.

The motion of the limbs and the axial organ that originate within such a system could only be planar. The didactic crutch that represents the anatomical planes of the body, has further narrowed or even closed the perception. Individual muscles and muscle groups were given the functions that are based on the autopsy description of the corpse. This also corresponds to the topography of the body and the muscles of a standing or lying figure of an adult individual with palms turned forward. Regulation of this simplified system is practically reduced to regulation of individual muscles and muscle groups.



Model of basic force ratios in tibial-femoral region

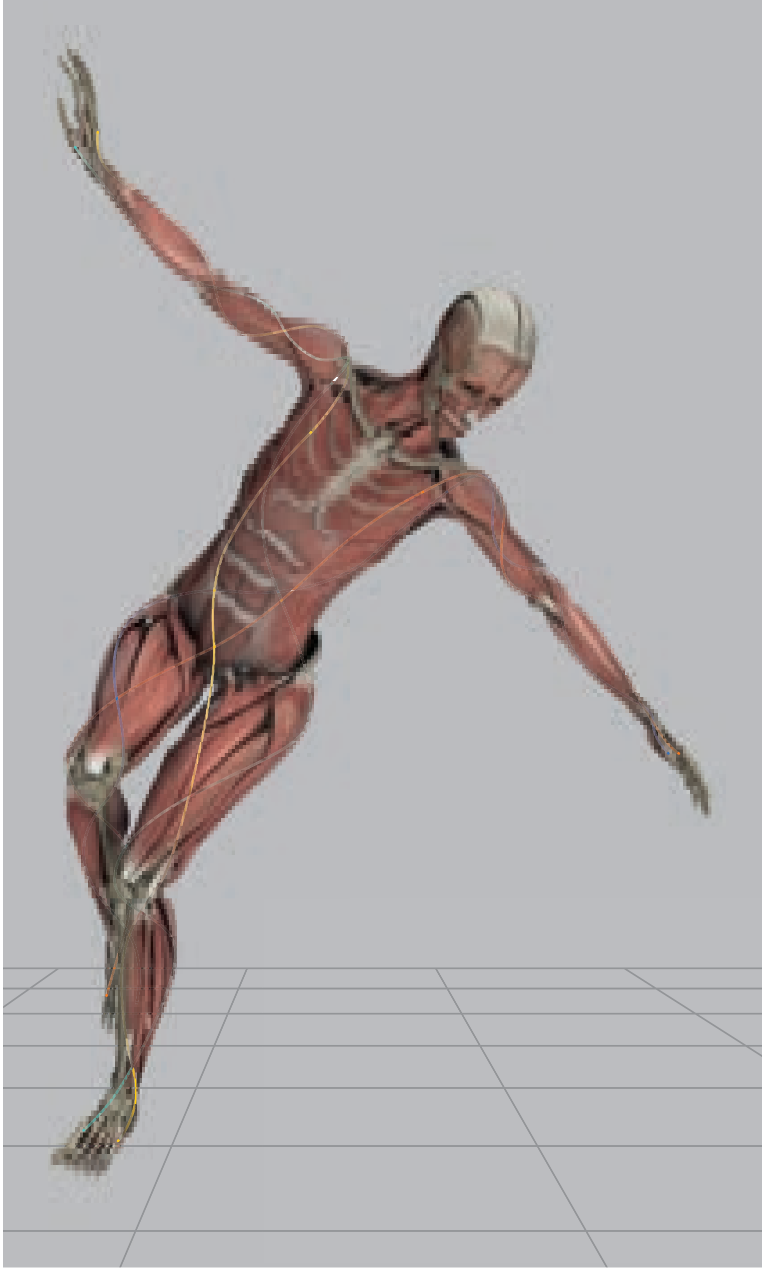
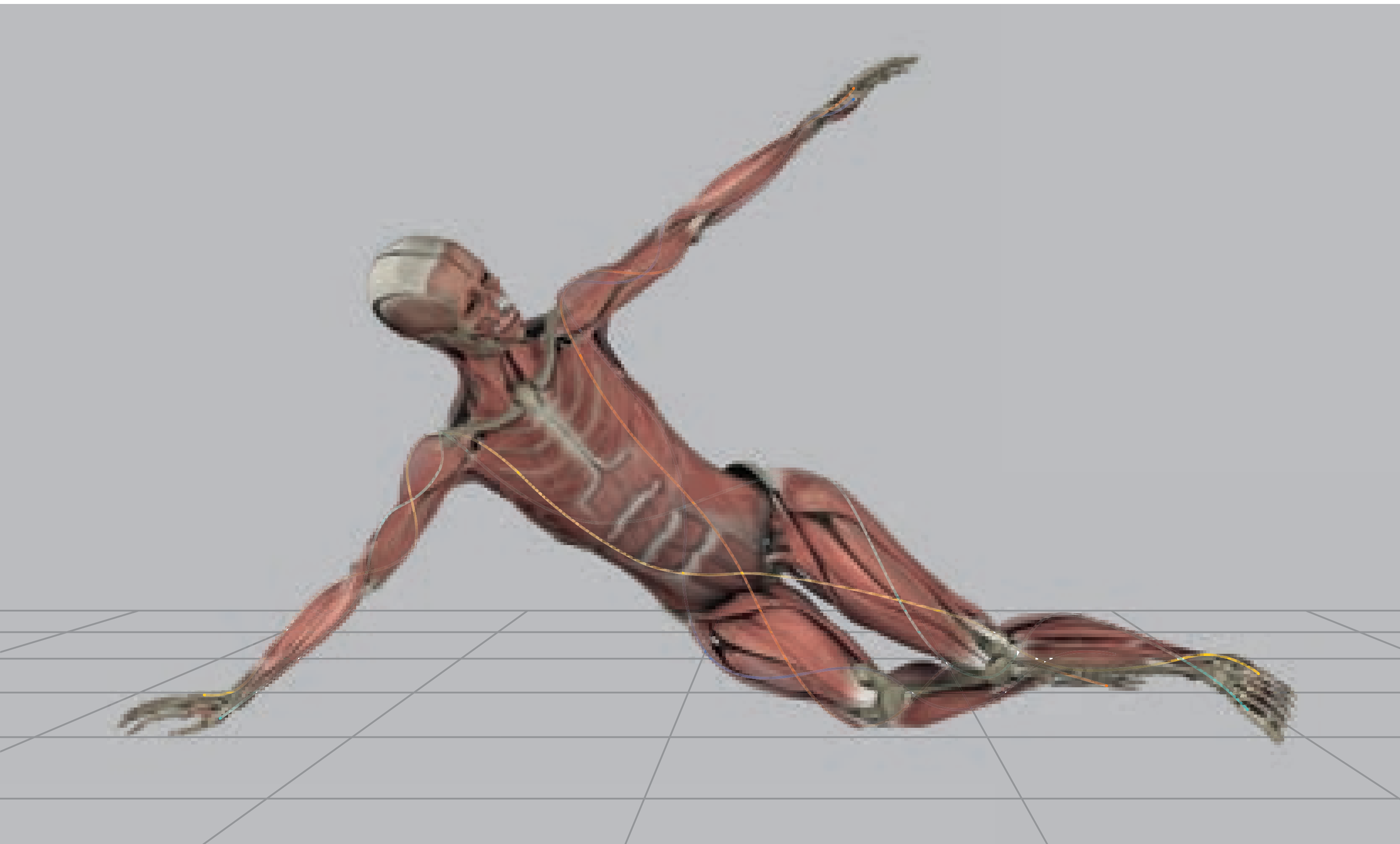
6.9 3D – Functional Anatomy

A functional 3D anatomical model is based on the observations of the real muscular functions. Muscle function is determined by the actual movement that is being performed by the musculoskeletal apparatus. Searching for the muscle function through its origin and insertion is secondary regarding the working of the musculoskeletal apparatus. Muscle functions are extremely variable and completely depend on their involvement within the muscular kinematic chains. The muscles are only the effector organs of the brain motor cortex. Their function constitutes the primary expression of the motor regulation by the CNS.

It is only necessary to look for the muscular functions in the actual movement in which the muscles participate. The locomotion of the musculoskeletal system is always global. It is based on the biomechanical principles. They are the only clue for the determination of the actual muscle function relevant for the current moment. Every next moment within the course of the movement that shifts the whole centre of gravity of the body and the limbs fundamentally affects the new and further changing functions of the muscles.

The attempt to describe the muscular functions on an “immobilised” torso or the limbs on the contrary results in a totally misleading image. Under physiological kinetic conditions, muscular function is “fluidised” and always changing. The real muscular function could be seen only in context with actual points of support and motion. In every moment, the supporting points show the direction of the “origin” of the muscle, from which the movement initiates. On the other hand, in each moment, the points of motion constitute the direction in which the muscle “inserts”. These “origins and insertions” continuously change during the course of the movement. If it wasn’t so, man wouldn’t be able to move within the 3D space at all. Movement, which has been trapped in a descriptive flat 2D anatomy, is totally non-physiological.

Depiction of the identical contour of spiral muscular loops in various body positions in different physical activities →

Support points during therapy in the position of reflexive lying

Depiction of locomotion with the help of “upper and lower differentials”

The action of the functional 3D kinematics can be well demonstrated on the locomotion of the limbless body.

Spiral muscular loops work like springs that are concurrently being pulled tight in opposite directions. In terms of mechanics, there are compression and tension types of springs. They provide the propulsion to the swinging kinematics of the locomotive apparatus of the human body. The very swinging kinematics is spatially oriented so that the centre of gravity of the body, the limbs and the head copy the spatial curves. These curves get close to the ideal only if they are sinusoidal in shape.

In terms of the influence on the very biomechanical construction of the musculoskeletal apparatus, movement through 2D trajectories is harmful. It doesn’t respect the essential rules of the function of the human locomotion.

Video

bit.ly/2nAwQLd

bit.ly/2n5tjlg

6.10
General Biomechanics of the Locomotion of the Human Body

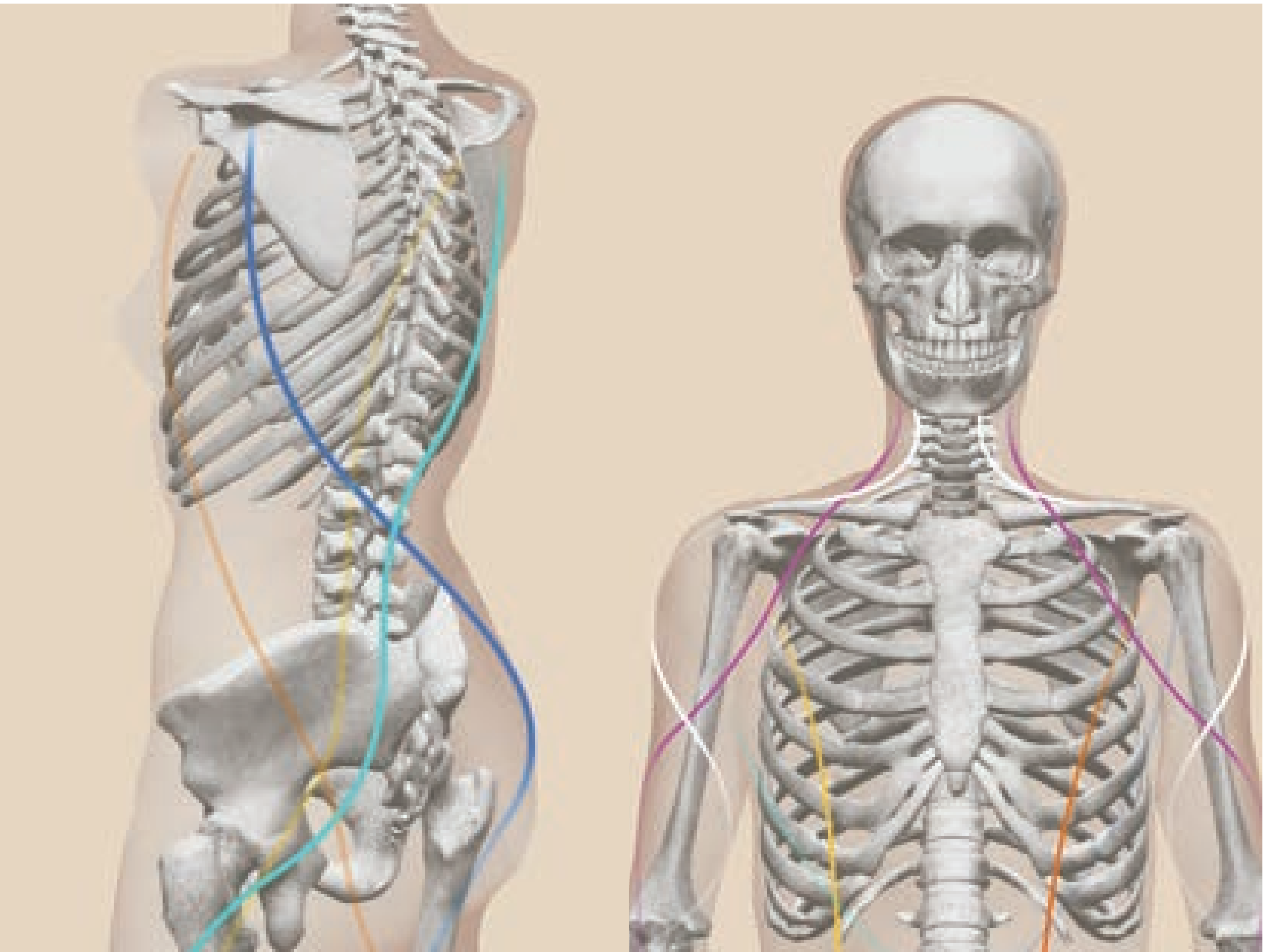
6.10.1
Musculoskeletal Apparatus in 3D Space – Spatial Course of the Movement

The musculoskeletal apparatus of the human body organised into the 3D spatial system becomes the fundamental precondition for the course of locomotion in 3D space. Vojta repeated very often, that the "posture follows the motion like a shadow". Spatial organisation of the bodily system should enable a course of movement that would always contain all three spatial motion vectors and would more or less approach the ideal symmetrical spiral trajectory in its course.

6.10.2
Biomechanical Construction of the Musculoskeletal Apparatus and the Spiral Dynamics of the Vectors of Motion

Clinical observation performed by V. Vojta allowed him to describe the muscular chains, which are responsible for the locomotion of the body. He classified them as straight or oblique chains and described their function in detail within the motor development from the birth to the unaided gait, in terms of both physiological and pathological course of development. The very courses of individual muscles indicate that the biomechanical construction of the musculoskeletal apparatus is built with regards to the combination of two components – the force and the velocity.

The implementation of muscular loop takes place in any position



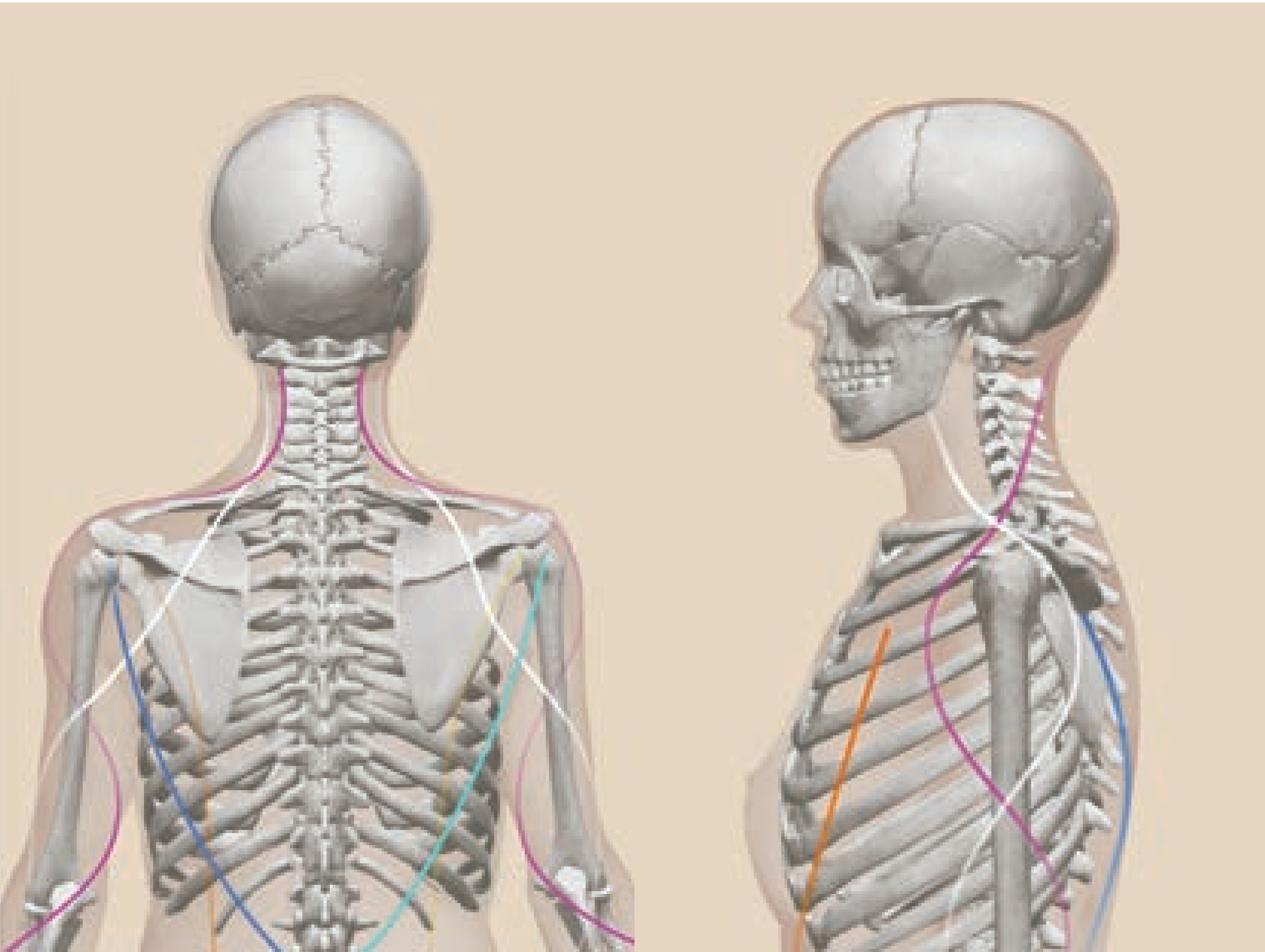
Basically, the system can be classified so that the force components of motion are situated rather medially on the axial organ, and rather proximally on the limbs (on the shoulder and hip girdles). Again, components responsible for the velocity are located rather laterally predominantly on the axial organ and distally in the limbs.

Combining the force and velocity components of locomotion, the musculoskeletal apparatus reaches the highest possible efficacy for which it's been constructed. It's capable of fast movements, predominantly on the limbs, as well as strong movements, predominantly on the torso. Of course, it also performs a wide range of exact and adjusted movements within the fine motor skills of the hand and in the orofacial region.

It turns out that the course of individual muscles, muscle groups and muscle chains is curved into a spiral. According to the steepness or the shallowness of each spiral it could be distinguished by whether it was determined for the creation of predominantly fast movement or predominantly strong movement, respectively. The spirals of great steepness have been constructed for fast movements with a great degree of acceleration but small degree of force. The spirals of shallow course have been projected for slow movement with a slow degree of acceleration, but they possess the capacity to escalate the force involved.

"Different muscles and muscle groups group together during all more complex movements into functional units – the functional chains are called muscular loops. These loops could

The implementation of muscular loop takes place in any position



generate a completely different motor expression that would correspond to contractions of each individual muscle contained within the respective loop. A kinematic chain is specific for each movement and changes even during more complex kinematic sequence. According to the ending of the chain, we recognise open kinematic chains. (The last link is free and doesn't contain a loop) or closed kinematic chains. (There is no free ending.)" (Kovařík and Langer, 1994)[9]

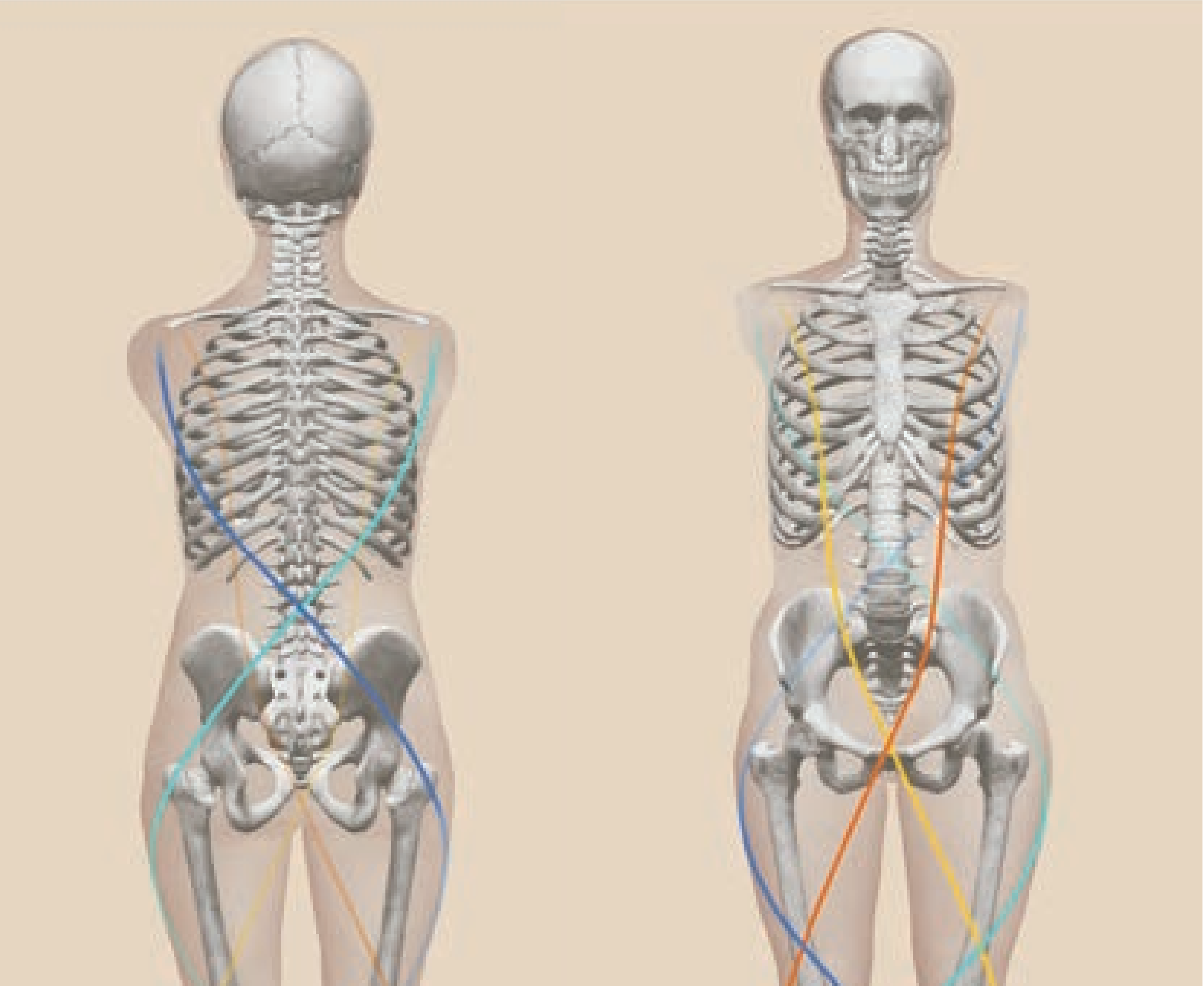
The implementation of muscular loop takes place in any position.

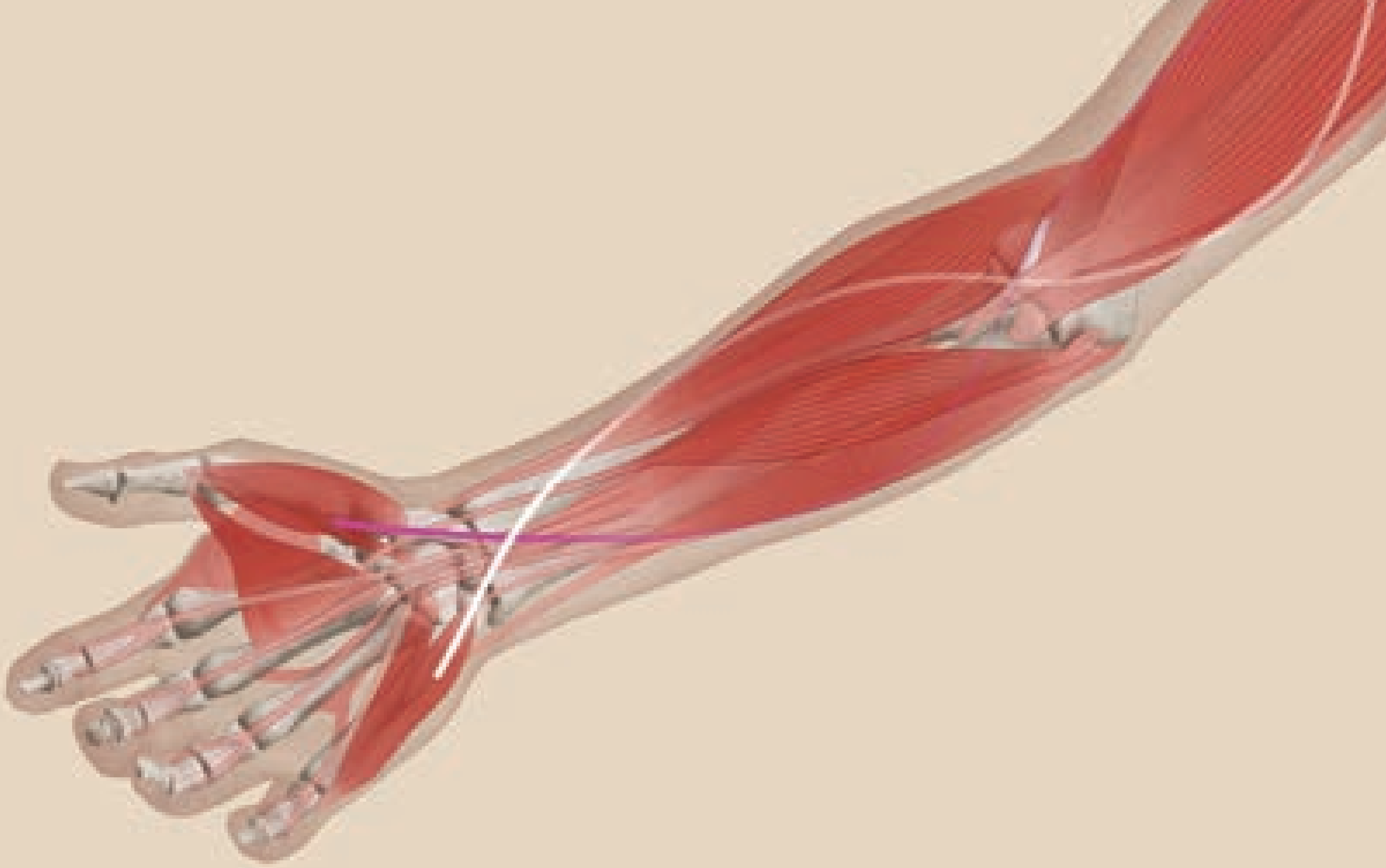
9 KOVAŘÍK, Vladimír – Langer, František. Biomechanika tělesných cvičení 1, 2. vydání. Brno: Masarykova univerzita, Pedagogická fakulta, 1994. ISBN: 8021008385.

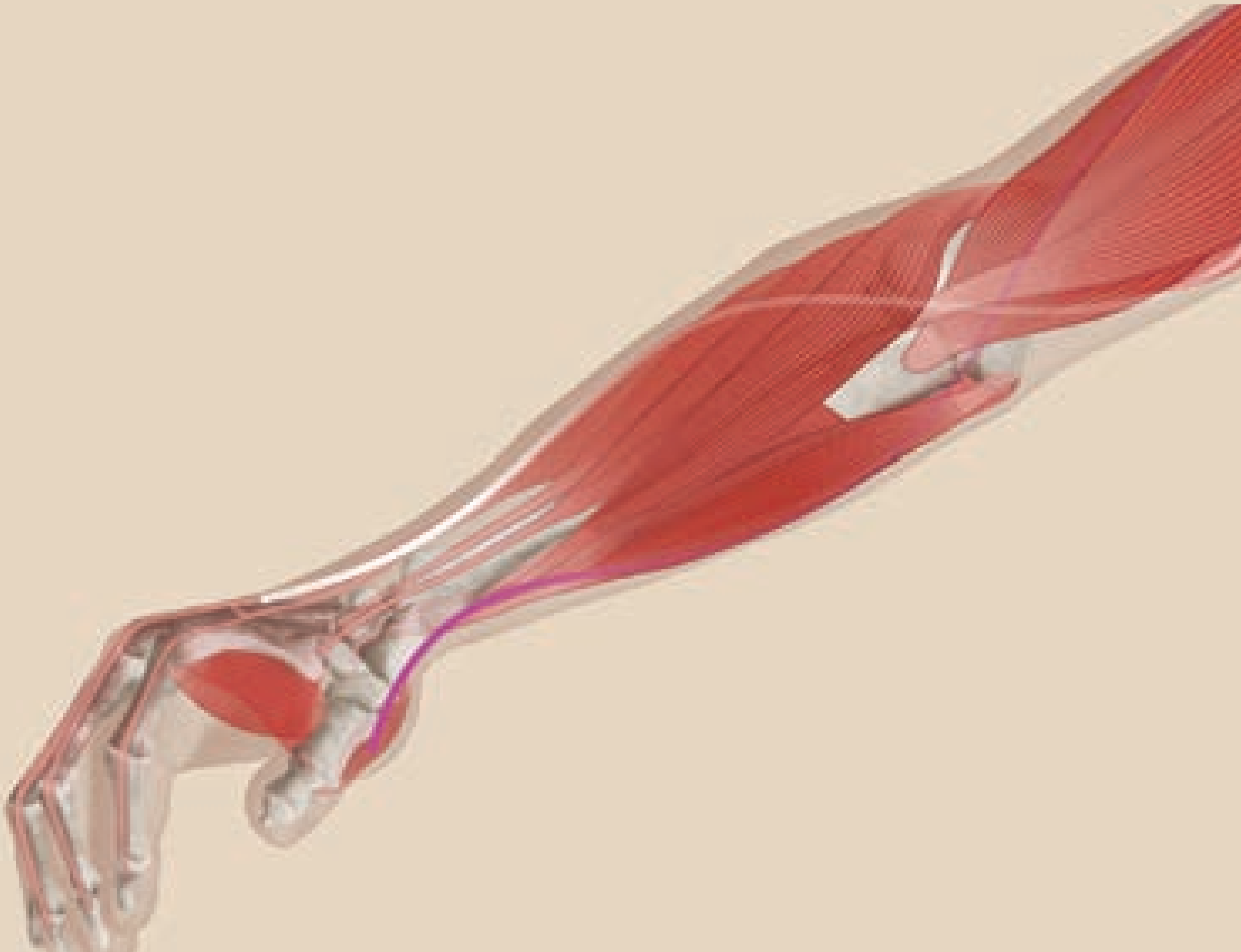
Muscle spirals wrap around both the axial organ and the limbs so that they rotate spirally around the medial axes. In the axial organ, they are formed by the ribcage, spine and pelvis; in limbs, they are formed by the long bones. The spirals describe curves in the right-to-left and left-to right directions. Forced expiration of the chest or clenching of the hand into the fist could stand for an example of concurrent "tightening" of the right-to-left and the left-to-right spiral.

Balanced regulation of the spiral locomotion is what enables the musculoskeletal apparatus to essentially move the body and all

Illustration of the physiological posture of the hand and the arm with the course of spiral muscle loops →





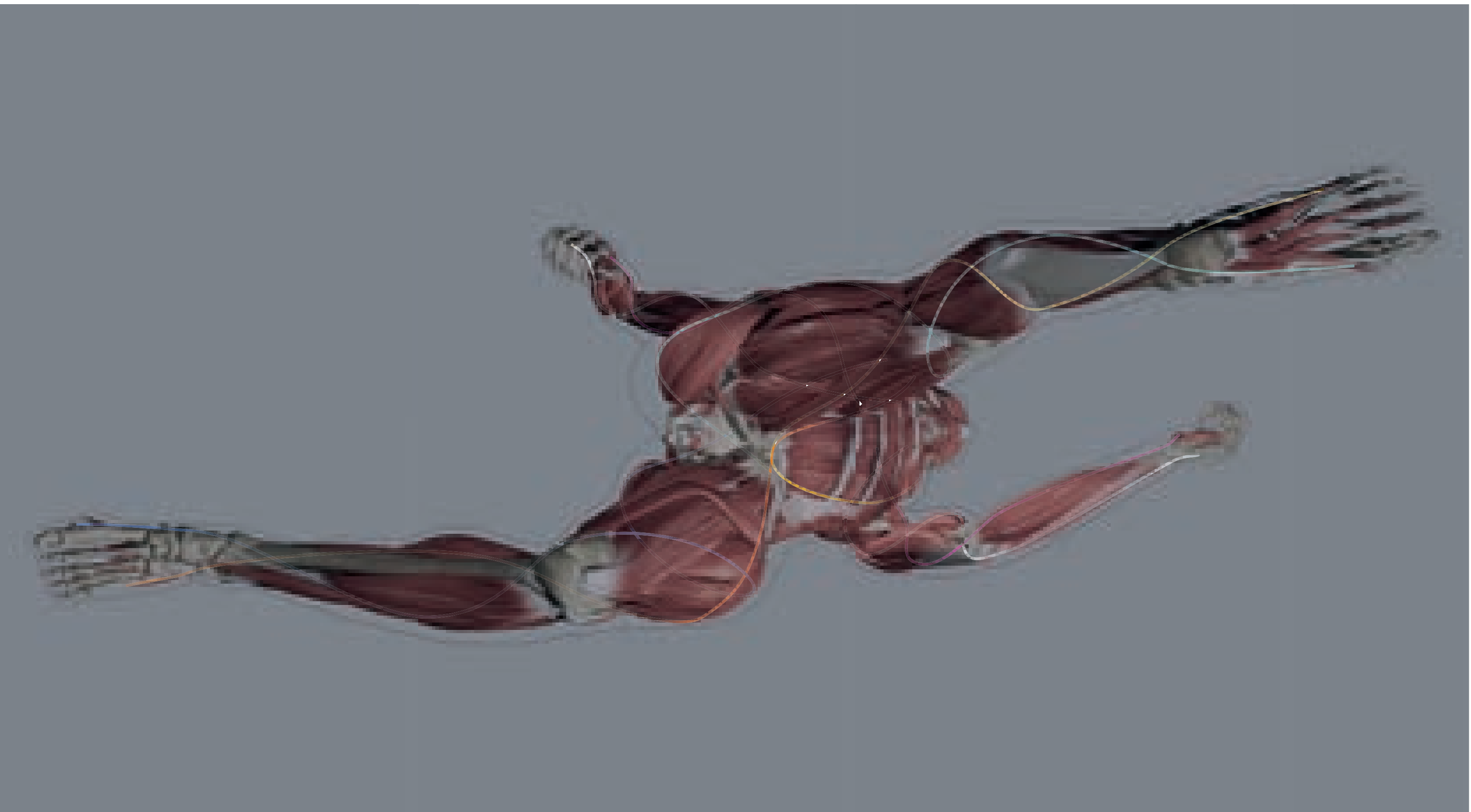


other extension motor formations. Permanent centration of all joints of the musculoskeletal apparatus, i.e. both the peripheral, bearing and spinal joints, is mediated by the spiral locomotion. The impairment of the regulation of the spiral muscular coordination leads to joint dislocations including the pathological shifts of intervertebral discs or knee menisci. Performance of the movement via spiral trajectories is highly economical and safe for the locomotive apparatus. Spiral trajectory occurs in all types of movements, and each stereotypical movement and its components are implemented through it. Spiral trajectory that approaches the physiological ideal approaches the rotatory ideal as well. The greater the deviation of the trajectory is from the physiological ideal, the greater the deviation is from its rotatory shape.

Deviated and pathological kinetic trajectories significantly increase the economical demands on the movement. The degree of the skeletal motor components' wear increases. Fatigue increases along with a concomitant decrease in the performance of the locomotive apparatus at all levels.

Schematic anatomical illustration of the "upper and lower differentials"

Illustration of the body within the phase of running
The result of the activity of the coordinated contractionary waves in the muscular chains



6.11 The Basic Preconditions for the Performance of the Normal Stereotypical Movement – Coordinated Contractionary Waves

To perform any stereotypical movement in an ideal way, all muscular chains must necessarily contribute to the ***coordinated contractionary wave.***

The regulation of the muscular coordination in the contractionary waves takes place according to a predefined algorithm. To perform the correct coordinated movement, it is necessary to provide ideal biomechanical conditions.

The course of the stereotypical movement in the contractionary waves of the muscular chains utilises all types of muscular contractions, i.e. the *isometric, dynamic* (formerly known as isotonic), *eccentric* and *concentric* contractions.

The result of the activity of the coordinated contractionary waves in the muscular chains

The current view of the muscular kinematic chains or muscular loop originates from the conception of the classical descriptive anatomy, i.e. the 2D view. Therefore, the chains and loops are only thought about and depicted in the planar sense.

Technical illustration of the shape of the development of locomotion from the supine position through to the lateral position to belly-crawling, crawling on all fours, supported standing and independent standing

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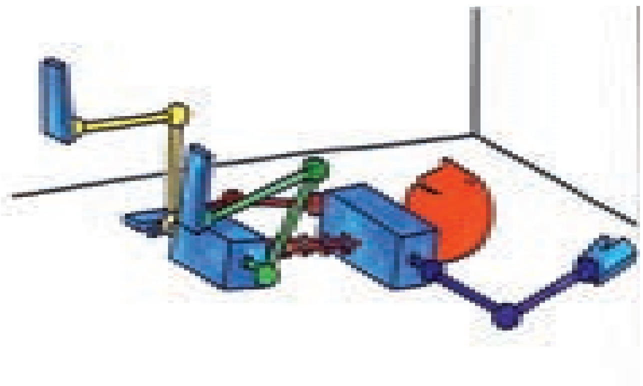

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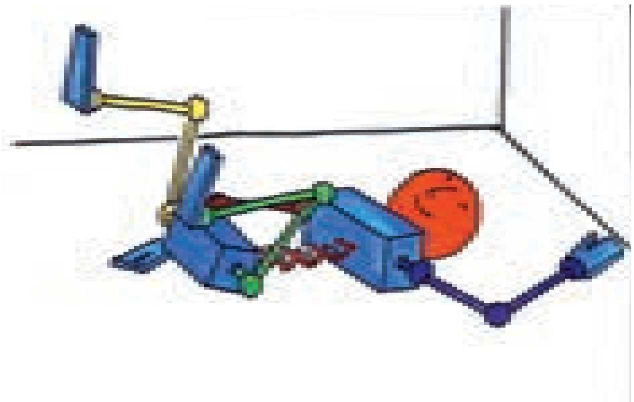

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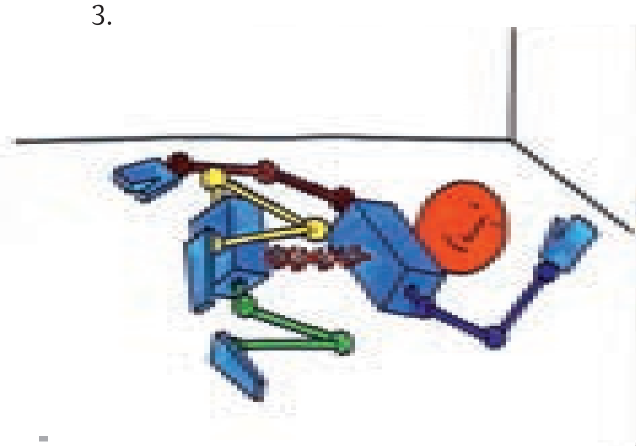

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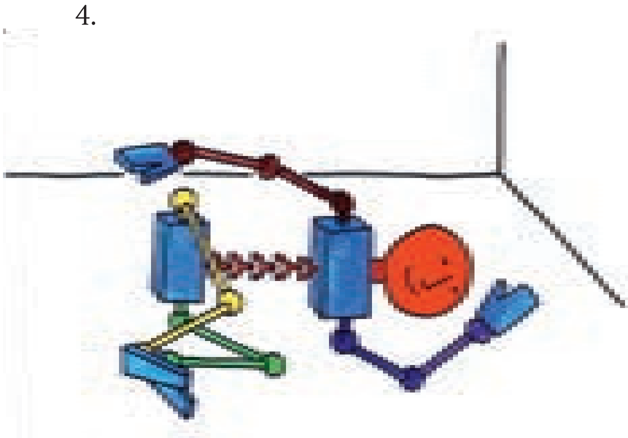
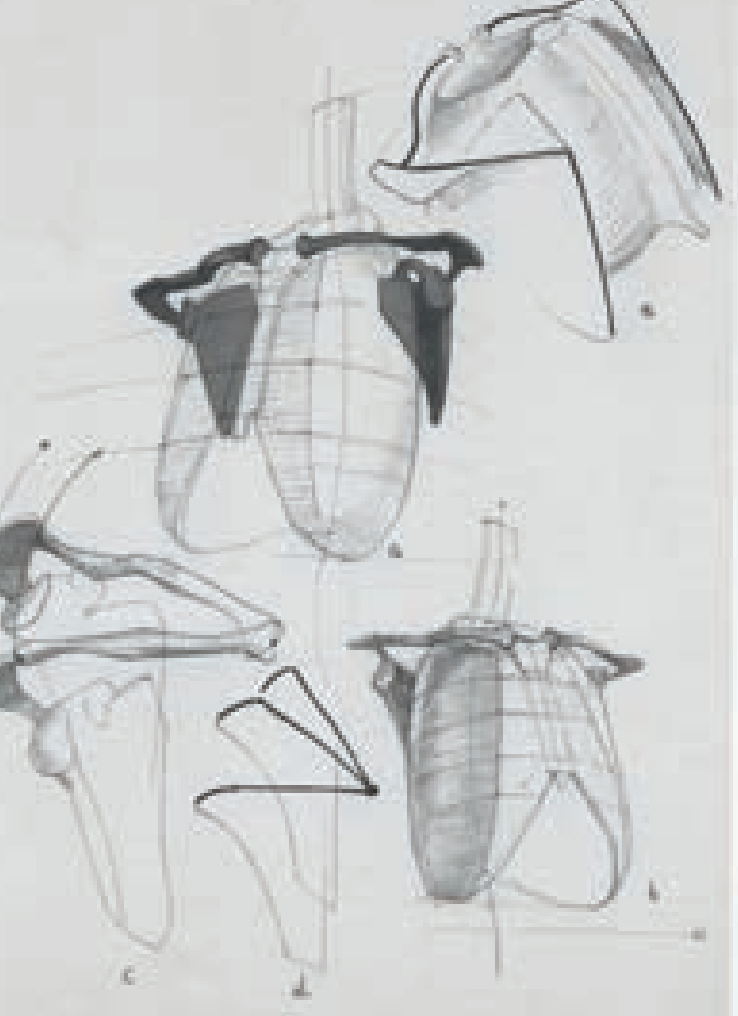




6.12
Foundations of the Developmental Biomechanics of the Locomotion of the Human Body

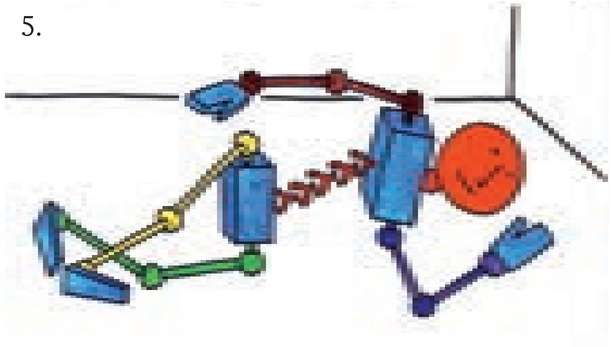
6.12.1
Functional Description

For easier characterisation and simpler illustration of the developmental biomechanics, we borrow the terminology of general mechanics of the machines. In terms of function, the

← Schematic anatomical illustration of the "upper and lower differential"

Technical illustration of the shape of the development of locomotion from the supine position through to the lateral position to belly-crawling, crawling on all fours, supported standing and independent standing

5.



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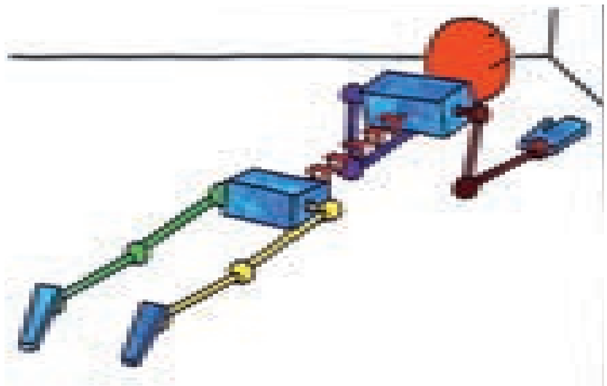

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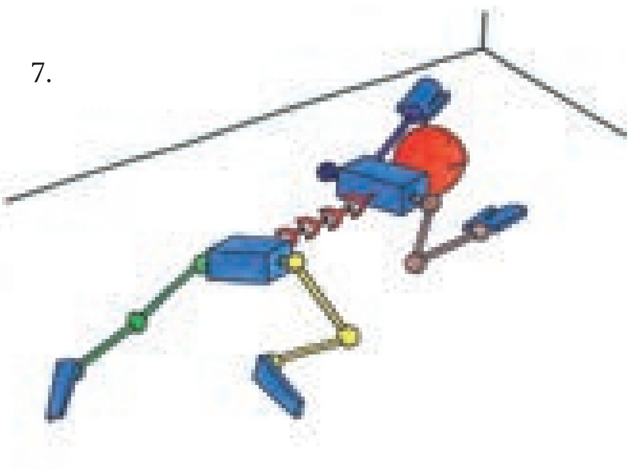

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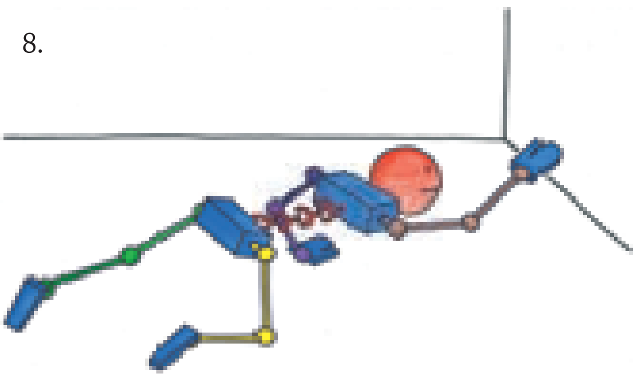
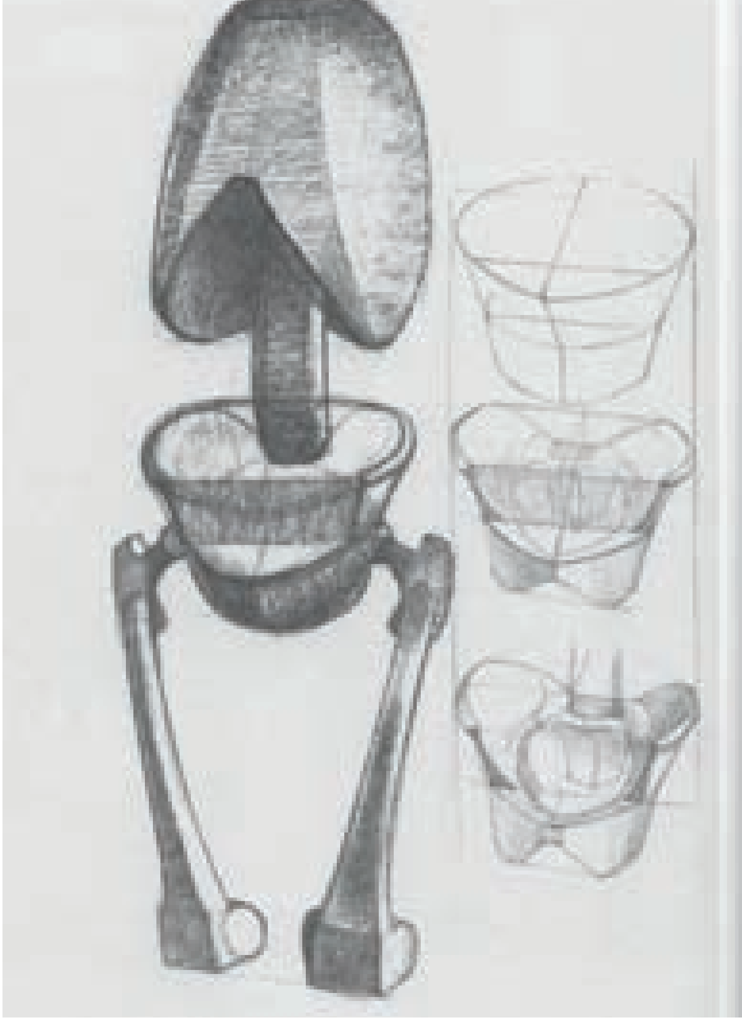


musculoskeletal apparatus of the human body represents a specific form of an extremely complex mechanical system.

The axial organ of the body itself could be divided into the pelvic girdle and the thoracic girdle with scapulae. We will call the pelvic girdle "the lower differential" and the thoracic girdle with scapulae "upper differential".

Both differentials, unlike those commonly used, e.g., automobile differentials, are triaxial.

Unlike the classical differentials that have been constructed for transmission of the



Schematic anatomical illustration of the "upper and lower differential" →

Technical illustration of the shape of the development of locomotion from the supine position through to the lateral position to belly-crawling, crawling on all fours, supported standing and independent standing

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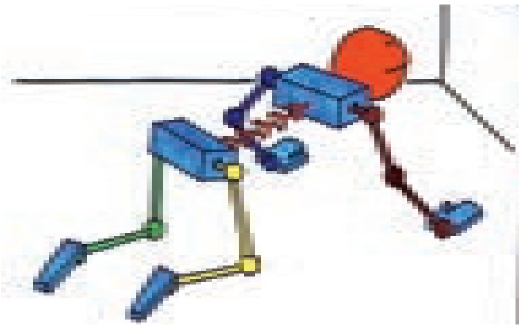

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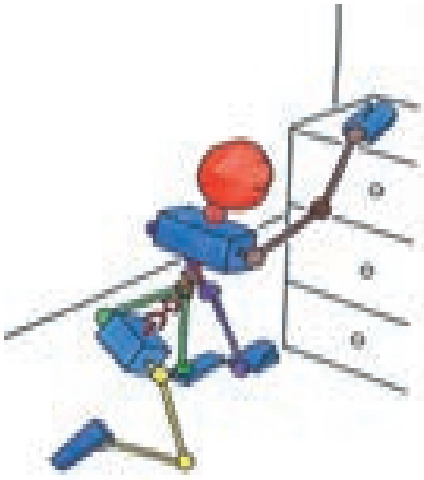

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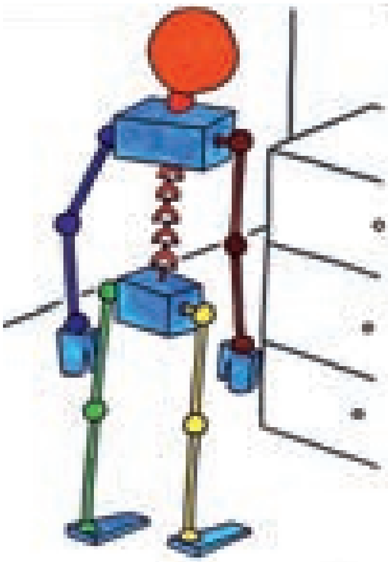

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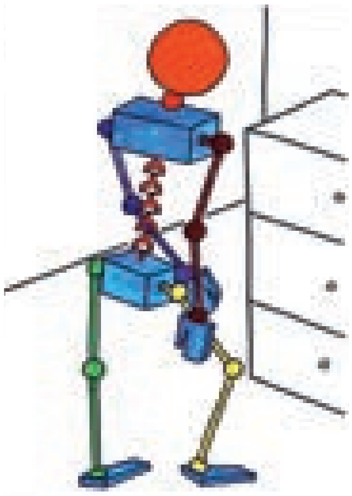


torsion momentum, the triaxial differentials of the motor apparatus of the human body have only been adapted for the transmission of momentums from swinging motion. These momentums are transmitted to forces of the levers of the limbs.

The lower pelvic differential transmits the swinging momentum directly to the lower limbs. This differential is a firm pelvic girdle and the connection with the lower limbs is secured by the robust musculature. Hip joints have been constructed as bearing joints with a limited range of motion.

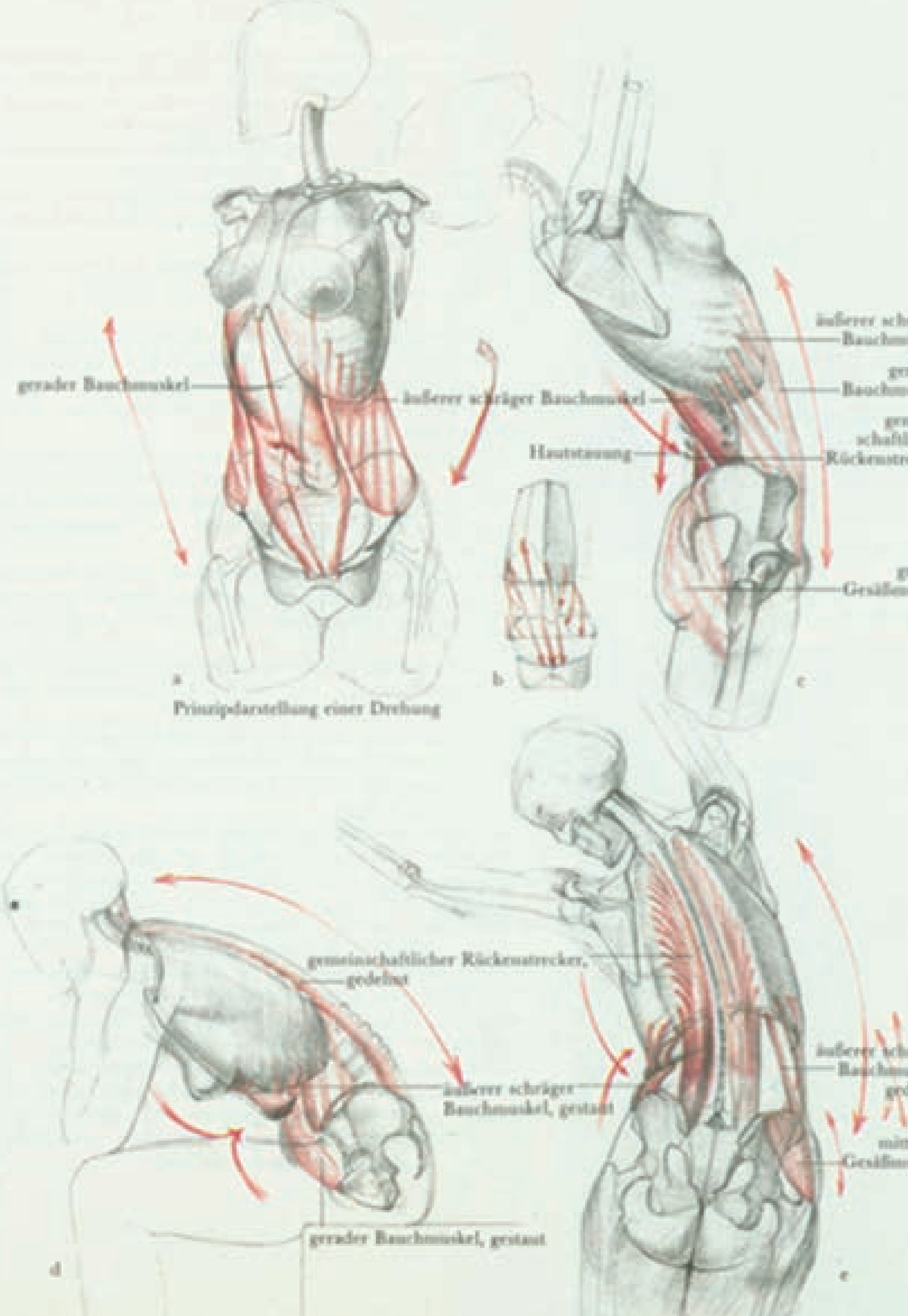
Compared to the lower one, the upper differential is significantly more complex due to scapulae that represent in a certain sense "inserted" bones. Together with claviculae, they constitute the foundations for two functionally and anatomically separate arm girdles. Concurrently, the bony base of the ribcage of this differential is more elastic than the pelvic bone girdle. The function of the upper differential, except the transmission of the swinging momentums to the upper limbs, is to ensure the functions of breathing mechanics and to carry the head. In terms of mechanics, the head could be viewed as a counterweight.

Connection and the transmission of the forces between both differentials is primarily enabled by the lumbar vertebrae L1 – L5, including the discs. In terms of general mechanics, they are the "cardan joints", which are, however, triaxial ones, too. Their function involves the transmission of the swinging force momentums between the upper and lower differential. Besides the mutual transmission of the forces between both differentials, these cardan joints indirectly contribute to the force transmission on the upper and lower limbs.

6.12.2
The Limbs – The Transmission Levers

In terms of general mechanics, the limbs could be considered the "transmission and efficient levers" of the system of the musculoskeletal apparatus of the human body. Their goal is to highlight the functional efficiency of the kinematic system.

The transmission levers significantly increase the efficiency of the whole musculoskeletal system of the human body, particularly the variability and efficiency of all motor skills.


gerader Bauchmuskel
äußerer schräger Bauchmuskel
Hautstauung
a
b
c
Prinzipdarstellung einer Drehung
gemeinschaftlicher Rückenstrecker, gedehnt
äußerer schräger Bauchmuskel, gestaut
gerader Bauchmuskel, gestaut
d
e

6.12.3
Head as the Counterweight

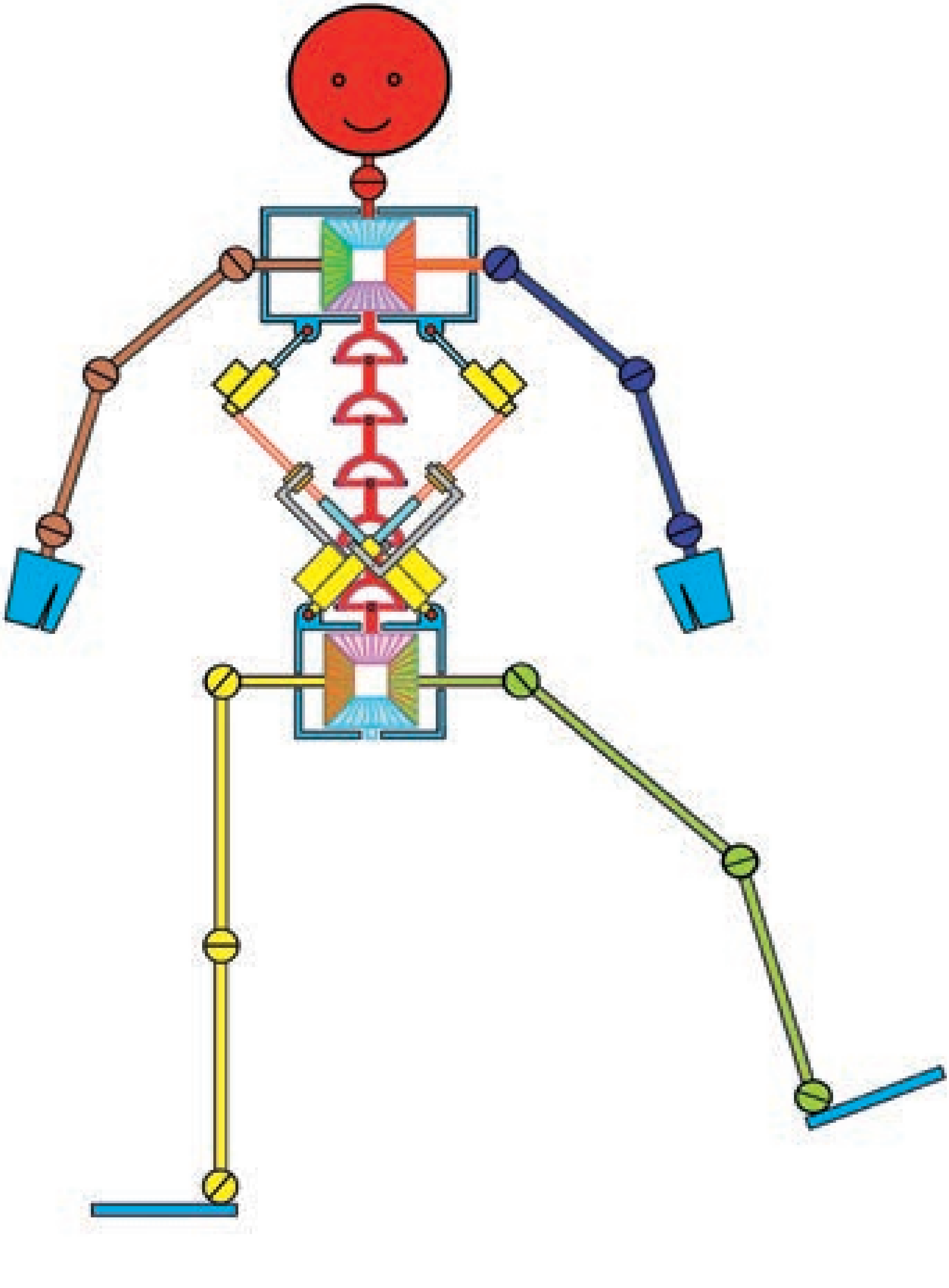
Again, in terms of general mechanics, the function of the head can be viewed as the counterweight suspended on the triaxial cardan joints, i.e., on seven cervical vertebrae. The mechanical role of the counterweight is helping to counterbalance the highly placed centre of gravity of the body during the upright bipedal gait.

6.12.4
Biomechanical Construction of the Musculoskeletal Apparatus and Its Interlinking

Current analytical conception of the musculoskeletal apparatus is suitable for the didactical purpose of the descriptive anatomy than for the real functional view. The description of individual parts of the body divided to the head, thorax with spine, pelvis, upper and lower limbs creates the generally mistaken illusion of some practically independent and loosely interconnected parts of the body.

The reality is shown to be different. The musculoskeletal apparatus can work only as a whole. Individual parts are completely intrinsically bound or rather chained in the structurally anatomical and, particularly, functional meaning. For easier understanding, the view of the body could be comprehended as multiple interconnected kinematic chains. These chains could be further classified as closed and opened ones.

The very kinematics of the interlinking of the musculoskeletal apparatus is very complex as it is intrinsically linked to the 3D anatomical model of the musculoskeletal apparatus. It exhibits a large amount of freedom within the kinematic vectors.



7. General Biomechanics of the Locomotion of the Human Body

7.1 Bridge Model of the Bearing Apparatus

The important process that happens during the locomotion of the human body, can be observed in the axial organ. It is the interplay between the pelvic girdle and ribcage with the scapulae.

The biomechanics of the locomotive motor skills of the human musculoskeletal apparatus show obvious resemblances to bridge

← Technical illustration of human biomechanics

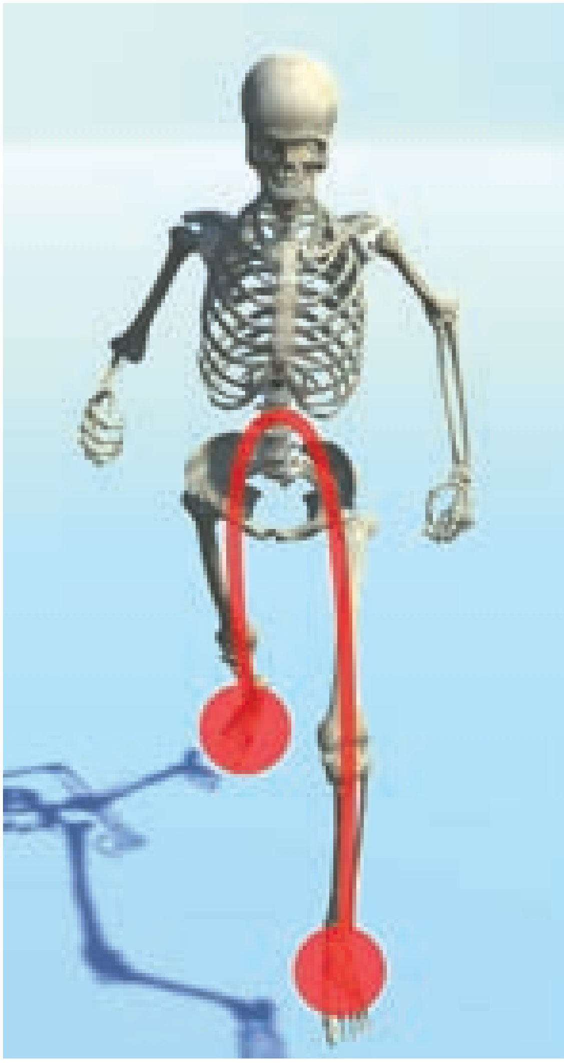
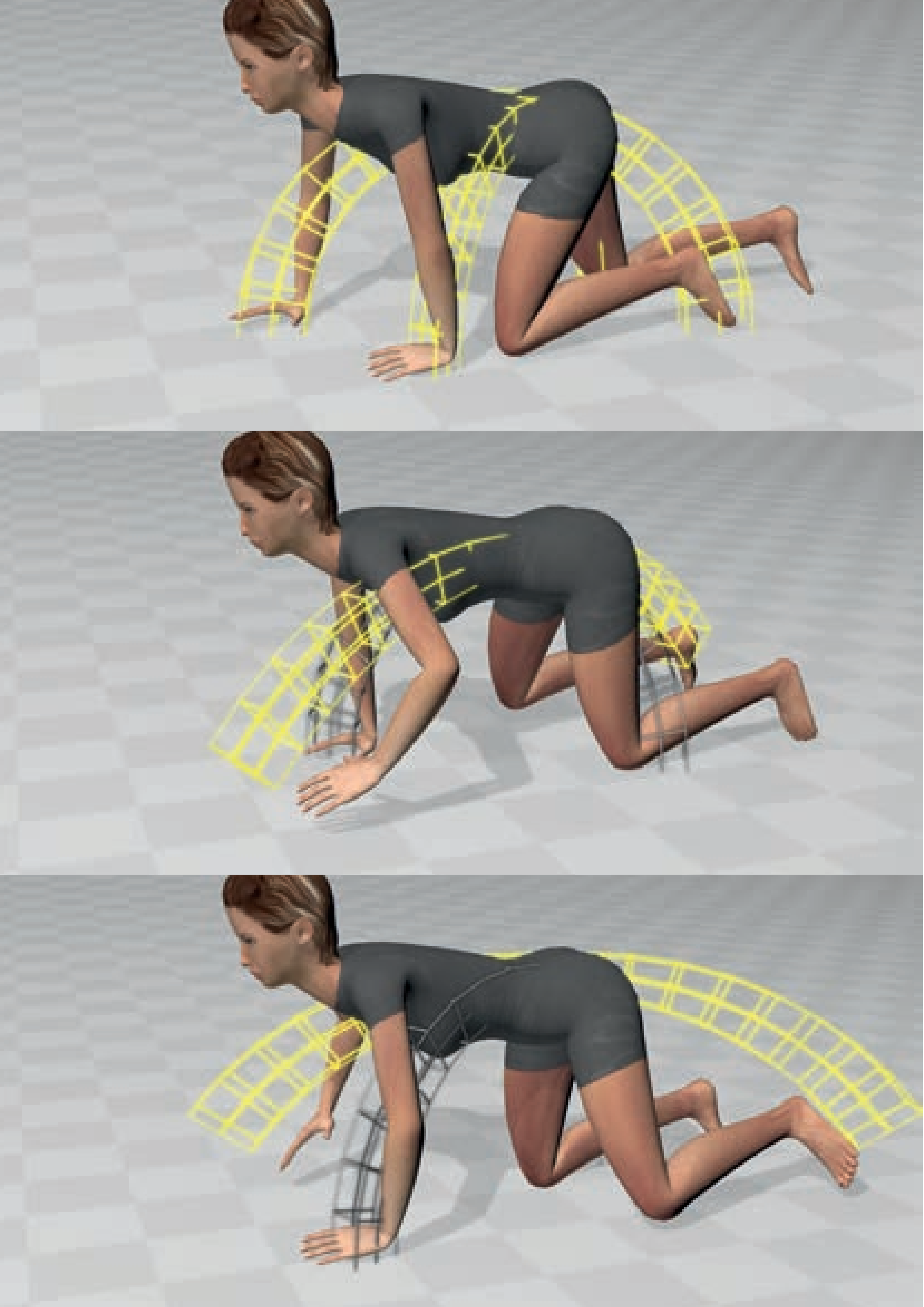


Illustration of the supporting point and the bearing arch in gait



architectonics. To convey the body on four or two limbs, it is necessary to create the conditions for the shift of the centre of gravity of the body first. It can be shifted in the gravitational field only so that it was borne beyond the supporting base or supporting points. In mammals, the limbs are used to this load-bearing role. In most cases all four limbs play a part. Rarely, as in the case of apes, it is only two.

The biomechanical construction of the human body that enables the upright gait on two limbs is the model of the most taxing type of locomotion of all so far known. Walking on two limbs is advantageous for several reasons. It's most advantageous in terms of economical demands because as it "pulls" the centre of gravity of the body forward, it uses the kinetic energy of oscillation of the stepping lower limb as well as the oscillation of the "virtually" stepping upper limb. It can change the velocity and the direction of the motion very easily. It permits movement on various types of surfaces and accommodates changes in the terrain slope. An upright gait improves the conditions for visual and acoustic orientation.

On the other hand, upright gait bears many disadvantages and complications. It entails difficult conditions for hydrodynamics of the blood and lymphatic circulation; supportive valves in vessels had to develop to help the venous blood and lymph to return from the lower limb. Acral parts of the limbs suffer from swelling during their insufficient activity. Load on the bearing joints of the lower limbs leads to extreme stress, which is transmitted on the rather small surfaces of the joint cartilages of the hip, knee and ankle joints. They tend to be the source of many pathological changes with subsequent impacts on the gait biomechanics and posture of the body. The length of the long bones necessary for a sufficiently long step (so that the gait would be economical at all) results in susceptibility to fractures. Vertical position of the pelvis is also stressful for the function of the lumbar vertebrae; their overload is also a common source of spinal disorders.

In terms of musculature, the lower limbs have been equipped with the largest muscular parts, which are the most demanding economically. Innervation of the large muscle parts

Animation

Rolling over
bit.ly/2lW4vPB

Scheme of bridge construction
bit.ly/2lilybs

← Illustration of changes in construction of the "bridge arch" and its changes during locomotion requires thick nerve fibres and wide plexuses of neural branching; these are also the common cause of impairments connected with the disorders of locomotion.

Complex knee joints are prone to damage of their soft and hard structures. Ankle joints are more durable, but hip joints are similarly prone to degenerative changes.

In terms of regulation of the locomotion, the upright gait is demanding and shows great fragility. For a flawless gait, it is necessary to harmonise many components together. Autonomic regulation of the posture of the body is one of them. Under physiological conditions, it shows the following feature: the frontal axis runs in the ideal medial line; similarly, the axis of the sagittal lateral view runs through the point of the external ear canal, through the centre of the shoulder joint, hip joint, knee joint and the centre of the heel.

Harmonised righting and balancing reflexes constitute the next precondition of a normal gait. Correctly initiated autonomic stereotypical movement of the gait in the first year of life is an important precondition.

Gait and the autonomic posture of the body are among the mechanisms regulated completely automatically from within the unconscious CNS structures. The possibility of conscious influence is rather illusory. Practically, the conscious regulation of gait and conscious regulation of our posture of the body is only possible for a few seconds. Afterwards, we "fall" back to our unconscious autonomic regulation again.

The disorder of the autonomic regulation of the posture of the body and the disorders of the autonomic gait mechanism are just responsible for the major part of functional disorders of the musculoskeletal apparatus. It seems to show that the effort to strengthen the musculoskeletal apparatus with strengthening techniques based on the anatomical 2D concept misses the expected effect and usually exacerbates the whole situation. They usually enlarge and worsen the existing muscular imbalances and thus make the conditions for the function of the disturbed stereotypes even more difficult. They result in partially strengthened muscular groups, which act something like an obstacle for the stereotypical movements and the autonomic regulation of the posture of the body.

For example, there was a comparative trial that focused on the carrying of weights. One group consisted of well-trained US marine soldiers. The other group consisted of Nepal Sherpas and women from Saharan Africa. The group of soldiers carried the load of fifty kilograms in backpacks specially tailored for military engineers. The other group carried the same load in bundles that were carried with one strap lying tight across the forehead or the upper part of the chest. Mostly, they wore simple sandals. The second group hadn't been trained in fitness gyms and the muscular "equipment" of their members was rather average. The result was that many soldiers in the first group were at the limits of their strength after day one. Meanwhile, the members of the second group still prepared food for the march on day two as it had been usual for them. After day two and three, respectively, most of American soldiers quit the march due to utter exhaustion. All members of the second group accomplished the march without relevant signs of exhaustion. Evaluation of the kinematic records of the way of marching of the soldiers showed that their way of walking with the weight was very inefficient as they were slowed down by the weight. On the other hand, the results of the kinematic analysis of the way of walking of Sherpas and African women showed that the carried weight, because of its kinetic energy, helped them walk.

Animation

Simplified biomechanics of the human body
bit.ly/2nULVIw

7.2
Biomechanical Construction of the Musculoskeletal Apparatus

7.2.1
The Origin and the Course of the Movement

If we analysed the movement patterns that enable a man to move from a place, and the targeted movements, e.g. grasping, a question would quickly arise*: when exactly can we speak of movement from a place?* The answer is: when the body can shift from the point A to the point B through its motor skills. There is a journey between points A and B that will be made. When thinking of moving from a place, we usually think of walking, running, crawling or jumping on two or four limbs. The observer can notice mostly large and fast movements. Nevertheless, they are only a noticeable outcome. They are not the essence of the movement.

During the analysis of the walking mechanism, only a small movement occurs in the spinal region in the beginning. It enables the shift of the centre of gravity of the body and the subsequent change in adequate posture. The spinal movement consists of many movements of individual vertebrae. These movements are very small and slow and go unnoticed easily. Thus, if comprehended, these small and tiny shifting and rotatory movements of the spine create the movement from a place themselves because these small three-dimensional movements of vertebrae make a certain "journey" – the trajectory.

The movements of individual vertebrae towards each other stand in a direct transformational relationship and depend on the movements of the limbs because through the free movement of the spine, full movement in the shoulder and hip joints can be achieved.

In terms of development, the locomotion begins with the movements that occur between the pelvic girdle and the ribcage in the supine position in the third month of postnatal life of the child.


8. Introduction to VM2G

People were created for beauty. This could be read in the biblical book "Song of Songs", which extols the beauty of the woman and the man.

> *"Your teeth are like a flock of shorn ewes that have come up from the washing, all of which bear twins, and not one among them has lost its young.... Your neck is like the tower of David, built in rows of stone; on it hang a thousand shields, all of them shields of warriors.... His arms are rods of gold, set with jewels... His posture is stately, like the noble cedars of Lebanon."*

This and many other books describe the beauty of the perfectly matured human body that underwent the flawless development of the locomotive apparatus. In clinical terms, we could say that such body has ideal poise, i.e. ideal posture, and that the basic stereotypical movements are perfectly balanced and coordinated.

The excellent condition of the musculoskeletal apparatus in terms of adequate amount of muscle and fat tissue and symmetry of the composition of "bodily masses" would be the third aspect.

All these aspects, if balanced between each other in an adequate ratio, create the preconditions for the true beauty of the female and male body: a charm that needn't be further glamourized.

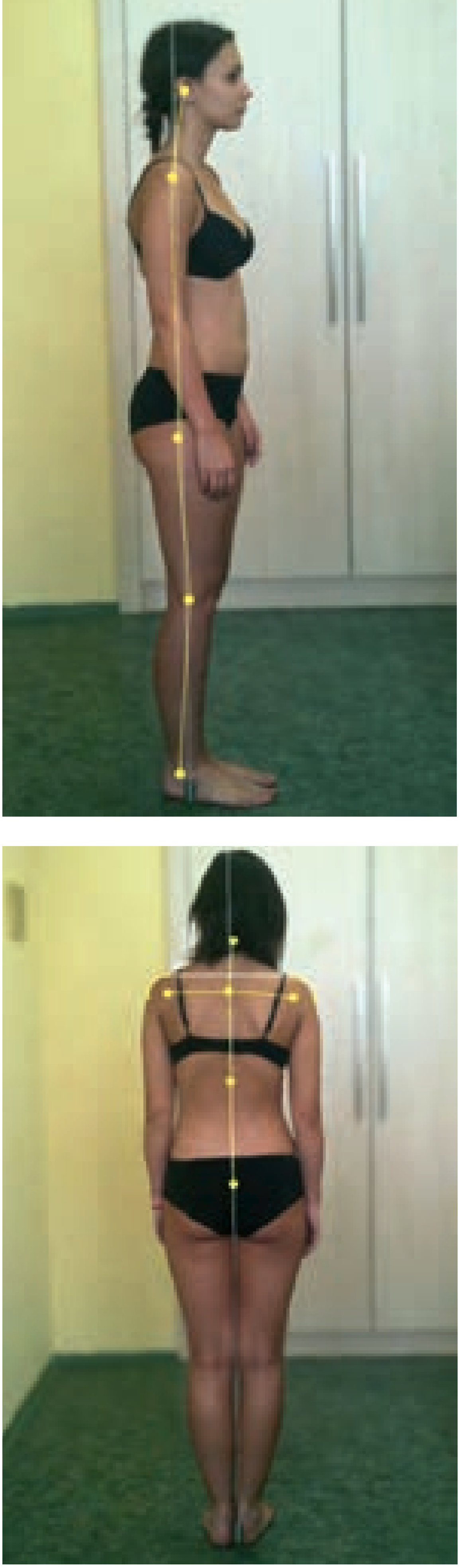
Many have tried to depict this beauty artistically since ancient times. It seems that renaissance genius artists Leonardo da Vinci, Michelangelo Buonarotti and Sandro Botticelli truly reached the peak. They understood that beauty is tightly bound to the functionality of the body. Thus, they precisely researched and described the anatomy of the human body. Without any doubt, pieces of art that have come from this knowledge represent the best of fine arts ever created.

This book also tries to translate the knowledge and experience that represent the way of healing the musculoskeletal apparatus. Reattainment of beauty and dignity of the human body is related to that.

A female patient convinced me of the important relation of the posture and movement of the body to its charms. She not only wanted to get rid of her back problems; she also wanted to walk elegantly in high heels. She has had problems with walking on high heels as the tips of her feet tended to turn inwards.

As will be presented later in this book, in terms of developmental kinesiology, inner rotation of the feet and turning the tips of the feet inwards is closely related to problems in the spinal region. Six months of therapy removed the back pain and enabled her to walk in high heels without any problems. Thus, it led to normalisation of her stereotypical gait. The high efficacy of this intervention that led to the beauty and smoothness of motion is a very favourable result. In the upcoming chapters, in the examples of several case studies, we can see for ourselves the results of the therapy that has led to usefulness and beauty.

Before the therapy



After one year of the therapy

8.1 VM2G as the Direction Towards Locomotion

We have been programmed for locomotion. In general, we can say that the more perfect the locomotion gets, the better lived life itself can be.

VM2G uses our own given and unchangeable genetic programming for locomotion. It's **the innate genetic program** with which the VM2G "works". It uses the program for therapeutic purposes. It's a program that has been intended to lead us after birth to the upright autonomic posture of the body against gravity and has enabled the a bipedal gait. This allowed the upper extremities to become specialised for grasping and manipulating objects. When this program reaches its target usually at about one year of age, it switches off automatically. It's useless as we begin to use the possibilities of the autonomic bodily posture and autonomic movement stereotypes.

VM2G works as the therapy that stands on the possibilities of changes of the mutual relationships of individual systems and organ systems of the human body.

Revoking the genetically determined motor program is the relevant process that happens during the implementation of the classical Vojta method and VM2G as well. This happens via the reflexive path through mechanical irritation of the reflex zones of the body. This process resembles the stimulus of the simple reflexes during the neurological examination, e.g., the patellar reflex. These simple reflexes are regulated at the spinal level and are also induced by a mechanical stimulus, most often through gently striking the relevant place on the body. The response to stimulation, which is easy to see, consists in prompt contraction of the respective muscle group and the subsequent immediate relaxation.

The global reflex, which has been used in the Vojta method, is regulated by cerebral structures, although it surely uses the spinal mechanisms too. The region at the centre of regulation of the global reflex is not known exactly. While it can be induced in patients in coma, we can presume that it is localised in the subcortical brain structures. The response is not the immediate contraction and subsequent relaxation of the muscles as in cases of simple reflexes. It is the slow connection of individual muscle groups into muscular chains. The resulting movement depends on the main muscular chains, which we have just induced in the reflex way. Which muscular chain is activated as a main one totally depends on the position of the body of the patient. It would determine the course of the reflex movement.

The basic "starting" setup positioning of the body is a necessary precondition for stimulating the global reflex. These "starting" positions are also necessary for stimulating single reflexes, e.g. we would hardly induce the patellar reflex in standing patient.

8.2 What Is Not VM2G

This is not an active exercise, during which we would try to change the actual status of the musculoskeletal apparatus with conscious effort. It's not an effort to change the current muscular length of individual muscles or muscle groups such as in stretching or yoga exercises. VM2G is not an active increase in strength of chosen muscles and muscle groups that takes place in bodybuilding and strengthening techniques.

8.3
Case Study – The Implementation of the VM2G in the Therapy of Severe Peripheral Palsies

8.3.1
Illustration of the Solution of the Postpartum Brachial Palsy

Monika was the youngest patient taken into our care. She was only 3 days old, when her mother brought her. The delivery went awry. The mother suffered a coccygeal fracture. When the delivery didn't go well, the obstetrician pulled the head with too much force. Thus, there was a complete palsy of the whole upper limb of the new-born from the scapula to the hand. The first neurological examination in the maternity hospital indicated that the condition was severe. The whole limb didn't show any movements and there were no responses to external stimulation. The mother was well informed about the risks of unfavourable development of the upper limb. She started the rehabilitative care with great zeal as she knew she was fighting for her daughter's future.

8.3.2
Description of the Problem (Clinical Findings)

A detailed history including the description of the delivery confirmed that there was complete brachial palsy of the upper and lower type. The traumatic manoeuvre injured the innervation of the muscles of the scapula, shoulder and arm, as well as the forearm and the whole hand. The muscles were completely hypotonic including the reflex joint hypermobility. It was necessary to be extremely careful during the treatment in order to prevent secondary trauma to the totally plegic limb. The efforts to induce any kind of neurological reflex on the affected limb were completely useless. A neurological report suspected the interruption of the brachial plexus root nerves as highly probable. The impairment of sensitive innervation was visible in the marble-coloured skin and the mild swelling of the whole limb. Motor functions of other limbs were completely normal. CNS function also did not show any impairment.

8.3.3 Expert Explanation of the Problem

Postpartum paresis of the upper limb represents extreme psychological and also subsequently physical stress for the mother of the injured new-born. The mechanism of the injury consists in the pulling of the head of the child stuck in the birth canal. The child's stuck shoulder results in stretching or partial to complete rupture of the root nerves of the brachial plexus. The disorder is usually represented by the upper type of palsy that affects the nerves innervating muscles of scapula, shoulder and arm. Lower type of palsy is less common. It affects the nerves innervating the muscles of the forearm and the hand. If both types of palsy occur concurrently, severe damage to nerve plexus could be suspected. There is usually stretching or partial to complete laceration of the root nerves. The prognosis of this condition is very severe. Without early, intensive and properly guided therapy that would use the regeneration potential of the nervous tissue, the future basal motion and primary functions of the whole arm and hand would be critically threatened. Early muscular denervation and subsequent irreversible morphological and functional changes in the muscles would develop, unless the intensive but adequate stimulation did use the possibilities of early regeneration of the nervous tissue. Insufficient innervation causes the remaining peripheral neural connections to fall under the influence of neural inhibition. Subsequently, the neural alienation would spread at the level of the central regulation. Hence, the whole affected limb misses out on any connection, i.e. regulation. In terms of developmental kinesiology, the dysfunctional upper limb entails great restriction for the development of the musculoskeletal apparatus. It is forced to search for substitute movement mechanisms that would replace the missing limb. The limb is eliminated from the kinetic muscular chains and the biomechanical bonds are impaired. This disturbed development might lead to significant muscular coordination imbalance in adolescence that could end with scoliosis of the spine or the ribcage deformity. If the therapeutic effort was meant to be effective, it would have to be aware of all these above-mentioned aspects. Intensive stimulation of the paretic nerves is extremely difficult. If it was performed consciously, it would easily lead to overload with a need subsequently for long regeneration. Stimulation implemented regarding the principles of the genetically determined motor programs bypasses this problem without any fear. The innate programs themselves have the feedback protection implemented. It would not permit the paretic muscles and nerves to become overloaded. These control mechanisms are reliable and tested by a longstanding practice. The other problem with the exercise of the paretic muscles under conscious effort is the development of synkineses. They disturb the very movement because the muscles, which are denervated less than others, join in movements, which they shouldn't. This problem is not known in reflex stimulation because the repair reflex programs predetermine coordinated stimulation, which wouldn't allow the development of synkineses. The third severe complication of analytical stimulation of paretic muscles is their incorrect connection into the muscular kinetic chains and the stereotypical movements. Reflex stimulation works within the basic stereotypical movement and would not permit any part of the locomotive apparatus to contribute to the kinetic stereotypes incorrectly. In the Czech Republic, the treatment of the postpartum brachial plexus palsy with the Vojta method is now obligatory. Our experience using VM2G seem to be very successful even in the most severe types of these injuries.

During the first year of age, the use of the Vojta method is relatively easy to perform, as the changes occur at the time of the child's unaided standing and walking. Due to the maturation of basic motor programs, the child has the possibility to disturb the induction of the stimulatory reflex. The option of rational agreement with the child of one to five years of age is quite restricted. That's why the Vojta method is usually finished and the parents are usually advised to stimulate the affected hand by putting the toys in it. This advice is a result of not understanding the conditions and abilities of the neurophysiological situation and the level of the mental maturation of the child. It is an unacknowledged fact that the child hasn't developed the stereognosis in the affected hand yet. The toy couldn't properly be recognised by touch. Thus, there is no chance of attracting the child's attention with it. If the motor function of the affected hand didn't fully normalise during the first year of age (which is rare in cases of combined upper and lower type of palsy), the continuation of the therapy with reflex stimulation would be necessary. The approach must respect the status of the child's mental development.

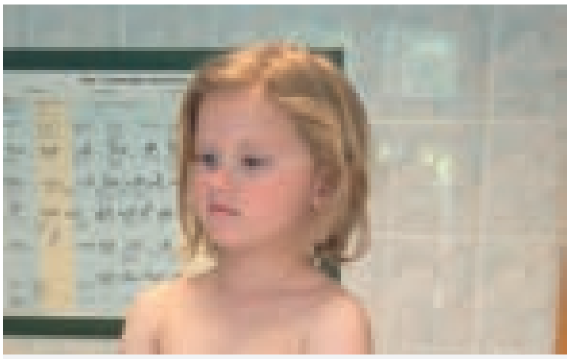
8.3.4 Illustration of the Solution

The very implementation of the therapy was extremely difficult. Right from the beginning, it was necessary to start with the reflex stimulation *by VM2G four times a day. In the first year, the check-up visits took place once a week. When the patient was six months of age, the more demanding kind of stimulation had to proceed. It was performed at home by the mother and another person. The second assisting therapist was the patient's grandmother, but for a certain period she had to be replaced by the aunt or a helpful neighbour from their block of flats. The influence of the intensive stimulation led to the gradual connection of the muscles in both the upper and lower parts of the limb. That's why the motor development could run normally during the first year. The hand gradually contributed to the normal stereotypical movements of turning, stabilisation on the side, grasping, crawling, support during standing on all fours, crawling on all fours and finally in the stereotypical gait. Since the time of unaided walking, it had been necessary to change the training approach. We started to use far more playful ways of diverting the attention like songs and nursery rhymes. Until three and half years, the exercises were performed twice a day with the help of the second home therapist. Later, the mother alone exercised with the patient once a day. In the next year, when the mother became pregnant, we tried to find a way to continue with Monika's exercises. The home exercises were quite physically demanding at that time and it was basically impracticable for the pregnant mother. The solution was found in the new conception of the implementation of VM2G with help from a home therapist. Little Monika quickly became fond of her "auntie Dáša" – the home therapist and the exercises continued very well. Little Monika has the right degree of respect and stopped to use her "tricks" to shorten the exercises as she had tried with her mother. The use of training clothes implemented another intensification of therapy and fun for Monika. Due to the proper and intensive therapy, the consequences of this very severe perinatal trauma almost normalised. The motion of the whole shoulder girdle and in the elbow was restored, and the hand is as adroit as the other. The stereotypical movements are normal. The only remaining problem to treat is an insufficient stability of the arm during the outer rotation.*

8.3.5 Explanation of the Solution

The course of the therapy and the recent result could indeed be considered as

Videa



Veselá Monika
bit.ly/2kUx2Rj

Video of the family interview
bit.ly/2ligiV6

acceptable. The initial highly uncertain prognosis of the future function of the hand quickly changed to assurance that the arm and hand wouldn't remain plegic and non-functioning. Severe trauma of the peripheral nerves requires the fastest commencement of therapy possible, which must be intensive and with the proper aims. The performance of VM2G enabled the start of the permanent maintenance of the reparative processes. The very process of neurogenesis and the inhibition of central alienation constitute the target of the stimulation. Due to use of genetically determined motor programs, it is possible to perform the stimulation with maximum efficacy without risk of overload. Feedback, which happens automatically in reflex stimulation, enables an amount of the stimulation that is practically independent on the external conditions. If the control system identified a potential overload, the stimulation switches off automatically. Its next activation is enabled when the nervous system regenerates and gets ready to endure the next stimulation load. The intensity of stimulation was gradually increased by technical aids. As Vojta highlighted, the aids help to increase the spatial stimulation of the stimuli. Temporal stimulation was maximally implemented, in the first year particularly, when the exercises were performed four times every day. All currently used therapeutic aids were implemented, i.e. stimulation balls, antiskid and balance mats, tilting of supporting surfaces and the training dress. In the subsequent years, the concept of using a home therapist was proved useful. She established a kind but uncompromising order during the exercise. This common-sense approach to setting limits was a relief for the whole family. The patient has tolerated the exercises with "auntie" very well without protests or evasive tactics.

8.3.6 The View of the Traumatic Postpartum Brachial Plexus Palsy and Its Solution in Terms of VM2G

VM2G has proved to be very useful in therapy of peripheral palsies of various aetiology, particularly in cases of postpartum brachial plexus palsies. Reflex induced repair programs are extremely effective and completely safe. It's the safety of the therapy that allows us to put the practical implementation into the hands of parents and home therapists. There is a remaining precondition of the leadership and supervision of the VM2G by an experienced physiotherapist. In the peripheral palsy, the functional impairment quite quickly spreads towards the morphological impairment. These functional and morphological impairments start to manifest in functions of other parts of the locomotive apparatus. Disconnection of the affected limb from the basic stereotypical movements may induce deformities of the ribcage and the spine with the tendency to scoliosis.

Therapeutic intervention of VM2G is manifested in the normalisation of the programs responsible for regulation of motor skills and subsequently in the normalisation of the trophic appearance. The goal is to completely normalise the motion of the affected limb, involve it fully in the stereotypical movements and normalise the whole locomotive apparatus and the autonomic regulation of the posture, including the basic stereotypical movements. The omission of the therapeutic intervention in children with traumatic brachial plexus palsy would be a source of significant future inhibition of complex development of the personality of the patient. The inhibition would manifest itself in many areas of life, i.e. education, sports and playing musical instruments. It also bears significant social stigma, including future economic activities.

9. General Theory of Regulation of Locomotion

This complex view comprehends the human musculoskeletal apparatus as a 3D anatomical concept, which consists of more 3D kinematic systems. The main difference between the 2D anatomical (analytical) concept and the 3D system of kinematic frameworks is that the 2D concept has only a small and finite number of degrees of freedom (i.e. independent ways of changing its own status), but the 3D system has a practically infinite number of these.

In mathematics, there are known technical approaches to solve this problem. If it weren't this way, these complex 3D systems couldn't be regulated at all. The whole complex clearly appears to be more than just a product of individual parts.

The locomotion itself and its "executive bodies" – the muscles – are regulated in global patterns. This view of musculoskeletal apparatus and its regulation is the essence of the synthetic therapeutic concept and future therapeutic and strengthening equipment.

Vojta has offered the *dynamic model* of the musculoskeletal apparatus that originates from the observation of the motor development of a child from birth to unaided gait at about 1 year of age. He started with the description of the dynamics of the individual muscle cooperation, then of the mutual interactions and subsequently of the developing coordination of muscular coordination. Finally, he arrived at the idea of global patterns.

The concept of regulation of locomotion in 3D also includes the spiral muscular dynamics based on three-dimensional space. Thus, it involves the three-dimensional anatomical structures and the motion in all three axes.

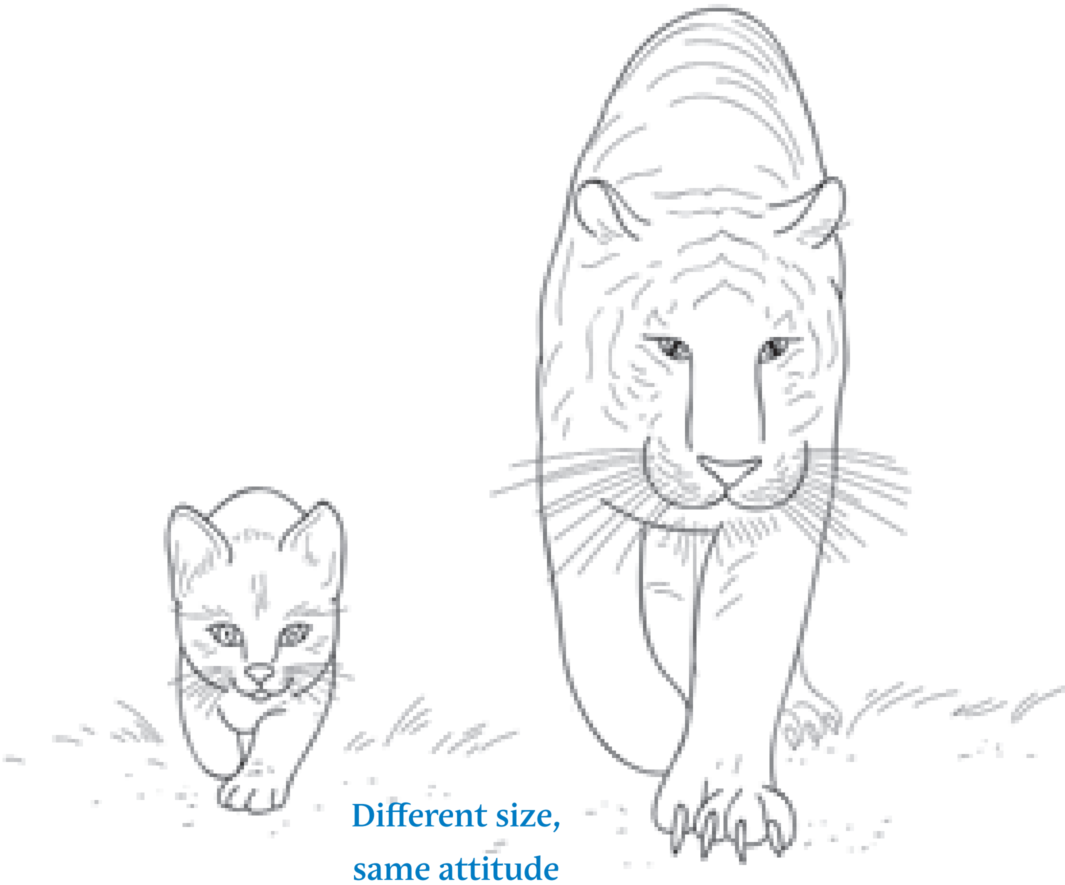
The human musculoskeletal apparatus would have great regeneration potential providing the body was used (regulated) in a coordinated way. On the other hand, incorrect movement (detuned regulation of motion) negatively influences practically all anatomical structures of the body. The system of regulation of movement has the ability of self-organising through permanent control mechanisms, but only to a certain degree. Subsequently, the necessity of active intervention comes from outside – "running" the *repair program*. The goal of the repair program is to re-establish the possibility of automated compensation of damages. The intervention of the repair program becomes necessary when the possibility of spontaneous reduction in entropy of the dynamic system by self-organisation is insufficient.

Permanent absorption of information and the control of purposeful and targeted action (movement) are the fundamental characteristics of consciousness and life. I believe that conscious regulation of human motion could scarcely encompass the regulation of the exact composition of the complex settings of the structures of the human body. Where exactly should a specific muscle be involved at a specific moment? What should its tension or angular velocity, etc. be like? Purposeful regulation of musculoskeletal apparatus must be largely located outside of the direct conscious regulation. Thus, it must originate from the unconscious subcortical cerebral structure. Existing basic models that describe the musculoskeletal apparatus as a system of opened and closed kinematic chains are grossly insufficient. They completely miss the more specific biomechanical and mathematical description of these chains.

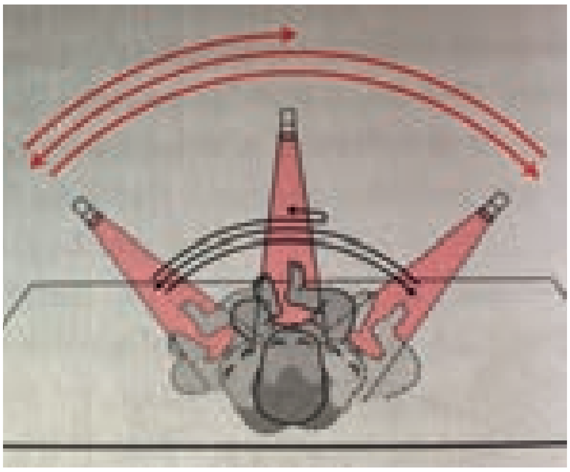
For an idea of how difficult the regulation of the course of the movement is, the example of bending the limb would be useful. We must consider that the resulting trajectory of the movement of the limb is a sum of several force vectors, which are generated by individual muscles of the limb and by other muscles of the body, which are involved in the autonomic posture and other stereotypical movements. Although the results of movement are generally predictable, its specific form is sensitively dependent on the fine details of the momentary positions of all parts of the body to each other and within the gravitational field, the angles of the acceleration and force vectors. This creates an appearance of randomness. The cybernetic view perceives the closed nature explicitly, and it researches the systems with regards to the fact that they can be opened and closed concurrently in relation to different characteristics. Therefore, the description of functions and outputs of the musculoskeletal apparatus is far more suitable in a form of closed and concurrently opened kinematic chains.

We can imagine that the cybernetic modelling may generate very important predictions. For example, there are cyclic processes, in which the result becomes the cause through the feedback, as it happens in a stereotypical gait.

The regulation of human locomotion can hardly contain the information on the exact composition of the complex structures of the human body: where exactly any joint or muscle should be, or what their setting or angular velocity should be. Or alternatively, it cannot



Different size, same attitude



Source of image: V. Vojta, 1993

have the information directly encoded. It must rather contain simple rules so that their implementation gives rise to complex structures. This dictates a certain analogy with fractals.

9.1 Formative and De-Formative Influence of Program of Regulation of the Motor Skills of the Locomotive Apparatus

Deformation of the musculoskeletal apparatus, which we would like to deal with, doesn't concern the primary disorders developed because of the influence of teratogenous (originated by false prenatal development) events, but the postnatal developmental disorders. These types of disorders are far less obvious than teratogenous impairments and their development is rather slow.

The musculoskeletal apparatus of the human body in maturation goes through remarkable changes particularly in the first year of life. This is in contrast with other mammals. The musculoskeletal apparatus of their young is practically a miniature of the body of the adult individuals.

The musculoskeletal apparatus of a newborn child is incomplete in terms of functional adjustment to the bipedal gait. Only very intensive maturation changes the angles of bones particularly in the lower limbs and the spinal curvature so that the child would be able to stand up without help and start to walk.

The maturation is a result of the action of two essential factors: the external influence of gravitation and the internal running of the genetically programmed motor skills program. In utero, the motor expressions could be observed as early as in the first weeks after conception. The complex coordinated movements are visible in the last trimester. In this period, the child can perform rotatory movements of the whole body in the uterus. It can make coordinated grasps with its hands and feet. All these motor abilities seem to disappear suddenly after birth.

The explanation of this event lies in the transition from a sense of weightlessness into the direct effect of gravity.

Gravitation becomes a very strong stimulus as it "switches off" the existing motor abilities of the child. After birth, under common circumstances, the child is practically unable to move in coordinated fashion.

The regulation of the coordinated movements seems to be practically switched off. The control over the child's body is taken over by the primitive reflexes. This regulation is manifested in so-called "holokinetic motor skills". This view is valid only in common, let's say operational, conditions of the newborn child.

Nevertheless in 1955, Arshavski and Krjuchkova (refer to V. Vojta, 1974)[10] demonstrated a completely different view with their research. Their observations proved that the autonomic posture and the locomotion of

10 VOJTA, Václav. Mozkové hybné poruchy v kojeneckém věku. Praha: Grada Avicenum, 1993. ISBN 80-85424-98-3.

the new-born might be global and precisely coordinated provided optimal precondition were created for such locomotion. So far these findings are largely unfamiliar in the field of developmental neurology. The statement that the locomotion of a new-born is "holokinetic", has been clearly refuted by the findings of Arshavski and Krjuchkova. Just these opinions allowed V. Vojta to build the basics of developmental neurology and developmental kinesiology anew. Refer to V. Vojta/Edith Schweizer: Die Entdeckung der idealen Motorik.[11]

The source of the figure: V. Vojta, 1993. [12]

Gradual maturation of the motor program has a formative influence over the whole musculoskeletal apparatus. The future image of the musculoskeletal apparatus in terms of morphology and function is being determined during the first year of life.

After birth, the musculoskeletal apparatus of the child doesn't show any practical signs that would predict whether the upcoming development would be successfully accomplished or would bear some restrictions or would be morphologically abnormal and functionally restricted.

The result of the whole course would become obvious during the following development, particularly after the accomplishment of its basic part in about the twelfth to sixteenth month of a child's age.

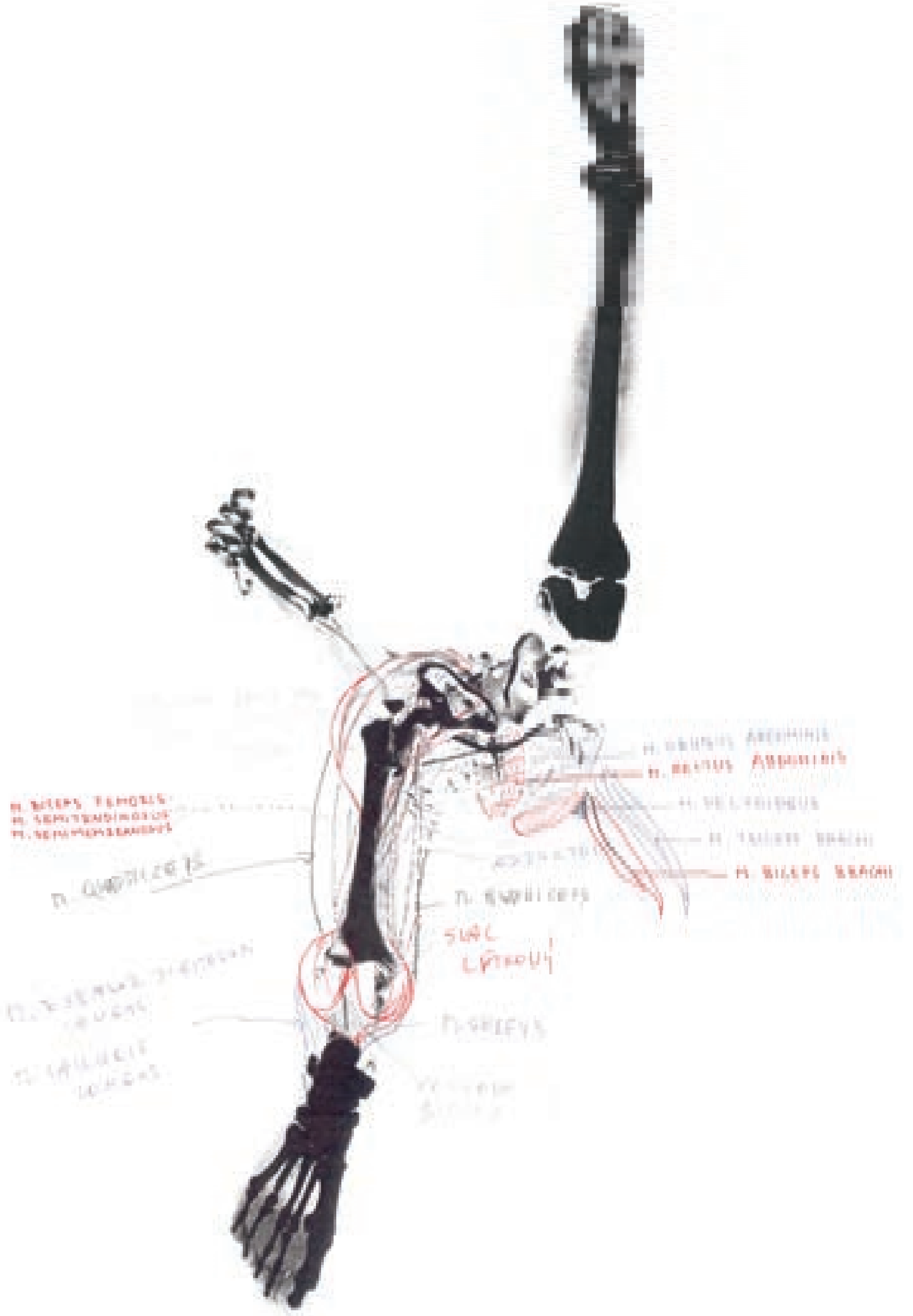
After birth, the motor program of the child is immature and unable to adjust to the demands of the movement of the musculoskeletal apparatus in gravitation. Compared to other mammals, this program is extremely complex. This complexity results from the demands on the bipedal locomotion.

In terms of the size and necessary "computing capacity", the program is so large to fit into the space provided by the brain of the new-born child. V. Vojta used a comparison that the human individual is born prematurely, as compared to other mammals, which are capable of unaided quadrupedal gait within a few hours (for ungulates) or within several weeks (for feline predators).

Motor programs of other mammals put incomparably lower demands on the abilities of the musculoskeletal apparatus. This particularly involves the basic stereotypical movements and the ability of further motor learning.

11 VOJTA Václav, SCHWEITZER, Edith: Die Entdeckung der idealen Motorik. München: Pflaum Verlag, 2009. ISBN 978-3-7905-0966-3

12 VOJTA, Václav. Mozkové hybné poruchy v kojeneckém věku. Praha: Grada Avicenum, 1993. ISBN 80-85424-98-3.


M. RECTUS ABDOMINIS
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SVAL LÝTKOVÝ

10. Motor Programs of Human Locomotion

The current paradigm of perception of the musculoskeletal apparatus and its regulation entails a deeply ingrained opinion on the possibility of "programming the basic motor functions". I think a program of such complexity, which would resemble the one that regulates the human locomotion, has not yet been created artificially. Rather than create a new one, we are more able to talk about the possibility of repairing the existing program. It's not about creating a substitute program – there is always a genetically coded and "intrinsically given" program that would be used. It could be its developmentally older program part or the developmentally younger program part.

Eventually, there is a possibility of running the genetically given program that has been inactive and dormant. It is necessary to distinguish between the programs that are responsible for the basic regulation of the musculoskeletal apparatus and the programs that enable motor learning.

Motor abilities have to be perceived as a form of function of the central nervous system. The regulation of the human musculoskeletal apparatus based on the clinical experience with the Vojta method seems to be close to the regulation of systems that are intrinsically complex, vast, morphologically soft, weakly constructed or otherwise unspecified. Similarly to the musculoskeletal apparatus of the humans, these systems are composed of many various parts with several mutual confused relations. They interact mutually by complex and scarcely comprehensible algorithms.

← Illustration of the body in the running phase

10.1 Neuronal Regulation of the Musculoskeletal Apparatus – Its "Software"

For better comprehension, I will try to illustrate the view of the program regulating the human motor skills by using a metaphor that would compare the programs of the human body to the programs that control a computer.

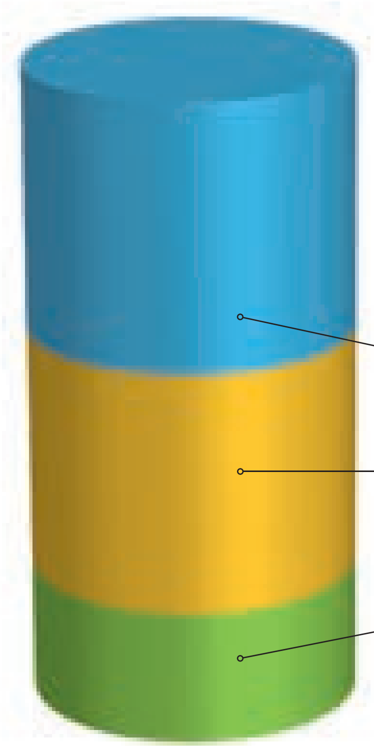
10.1.1 BIOS

Like a computer, the human brain has a quite elementary start up BIOS program, which an ordinary computer user does not come in contact with it.

BIOS is a system providing the most elementary functions. It is a "hard-wired" system, so the possibilities of configuration are significantly limited.

BIOS is the basic driver for the motherboard. It is a set of primary instructions that are necessary for the computer to run a specific operating system such as DOS, Linux or Windows. Moreover, it influences the performance and the stability. If BIOS is damaged, computer is unfunctional.

"BIOS" of the human brain is represented by a basic program that is responsible for the regulation of the so-called vital functions:



Distribution of the individual programs during the maturation of the brain in the first year of life. Application programs are completely missing. This way, we would schematically express the distribution of the motor skill programs in the child from birth to about six months of age. The development has a normal course and individual layers of the programs are separated from each other. The substitute program is still large and takes a lot of space in the brain.

- Regulation of the body temperature – centre of thermoregulation is situated in the diencephalon (hypothalamus);
- It involves the constriction and dilation of the skin vessels – regulation of the blood pressure and pulse;
- Regulation of respiratory functions – the respiratory centre is located in the medulla oblongata and pons;

The program is formed within the first weeks of intrauterine life. Similarly as with computer BIOS, it is "hard-wired" and cannot in actuality be changed. As in computers, it influences "the performance and the stability" of the operation of the human body. Function of the human BIOS is a precondition for running of the "operating program of motor skills" and as with the computer, if the program regulating the vital functions was damaged, the human individual would die as well.

The next layer of regulation that influences the motor skills of the musculoskeletal apparatus is the "Basic operating program of motor skills".

The program that is fully responsible for the regulation of the basics of our motor skills is the *basic operating program of motor skills.*

Again, for better comprehension, we would borrow the analogy from the world of computers.

The operating system represents the essential software equipment of every computer. This software runs all technical parts of the computer and provides operational environment for other programs.

Simply put, the operating system collects and controls every operation. If it didn't, every application would have to perform these activities alone and that would lead to many difficulties (hard drive storing – the files could be overwritten, etc.). Operating system starts with the computer and stays active until the computer is switched off.

It consists of the core and accessory system tools. The main goal of the operating system is to provide the user with the possibility to control the computer, to establish stable application interface and supply the applications with system resources. The operating system is a very complex piece of

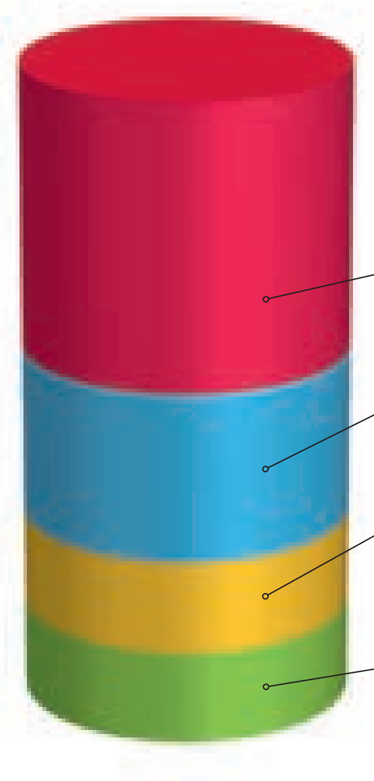


Figure of ideal distribution and tuning of all programs enabling the performance of the most complex motor skills, e.g. ballet.

software. Its development is more complex and difficult compared to the development of ordinary programs.

The best known operating programs are Windows, MAC-OC, LINUX, ANDROID and the older DOS.

Similar construction and function could be found within the ***basic operating program of motor skills.***

We can find the "program core" responsible for the regulation of the basics of motor skills. These contain several necessary building blocks, without which the normal motor skills wouldn't get by. Creation of these functions on the somatic level, i.e. the myelination, establishment of neural connections, building of neuronal networks and the creation of "virtual maps" take place at the level of genetically determined information without a conscious or targeted learning process – only through maturation.

The human operating system has the following tasks:

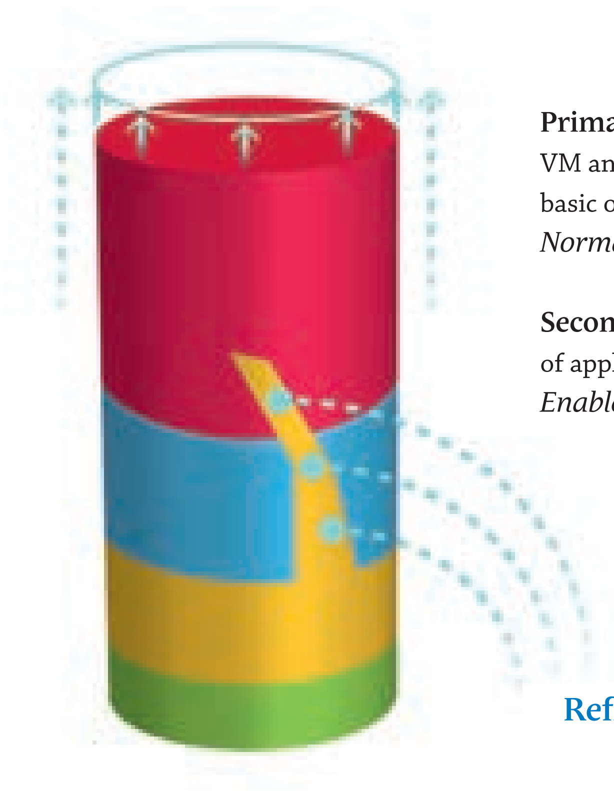
I. Autonomic regulation of the posture of the body that has "sub-programs" for management of:

- Autonomic regulation of the resting muscle tone
- Autonomic regulation of the resting muscle coordination
- These two programs create the autonomic regulation of the resting joint centration.

II. Autonomic regulation of the basic stereotypical movements that has the "sub-programs" for control of:

- Autonomic regulation of antigravity and righting programs
- Autonomic regulation of the balance programs
- Autonomic regulation of the coordination of the muscle tone during the movement
- Autonomic regulation of the muscle coordination during the movement
- Autonomic regulation of the joint centration during the movement

Neurophysiological view of the program for “repair of locomotion”



Primary therapeutic influence of the implementation of VM and VM2G in patients with milder impairment of the basic operating program
Normalisation of the operating program by “healing”

Secondary influence on the “healing” and development of application programs
Enables their development, growth and strength

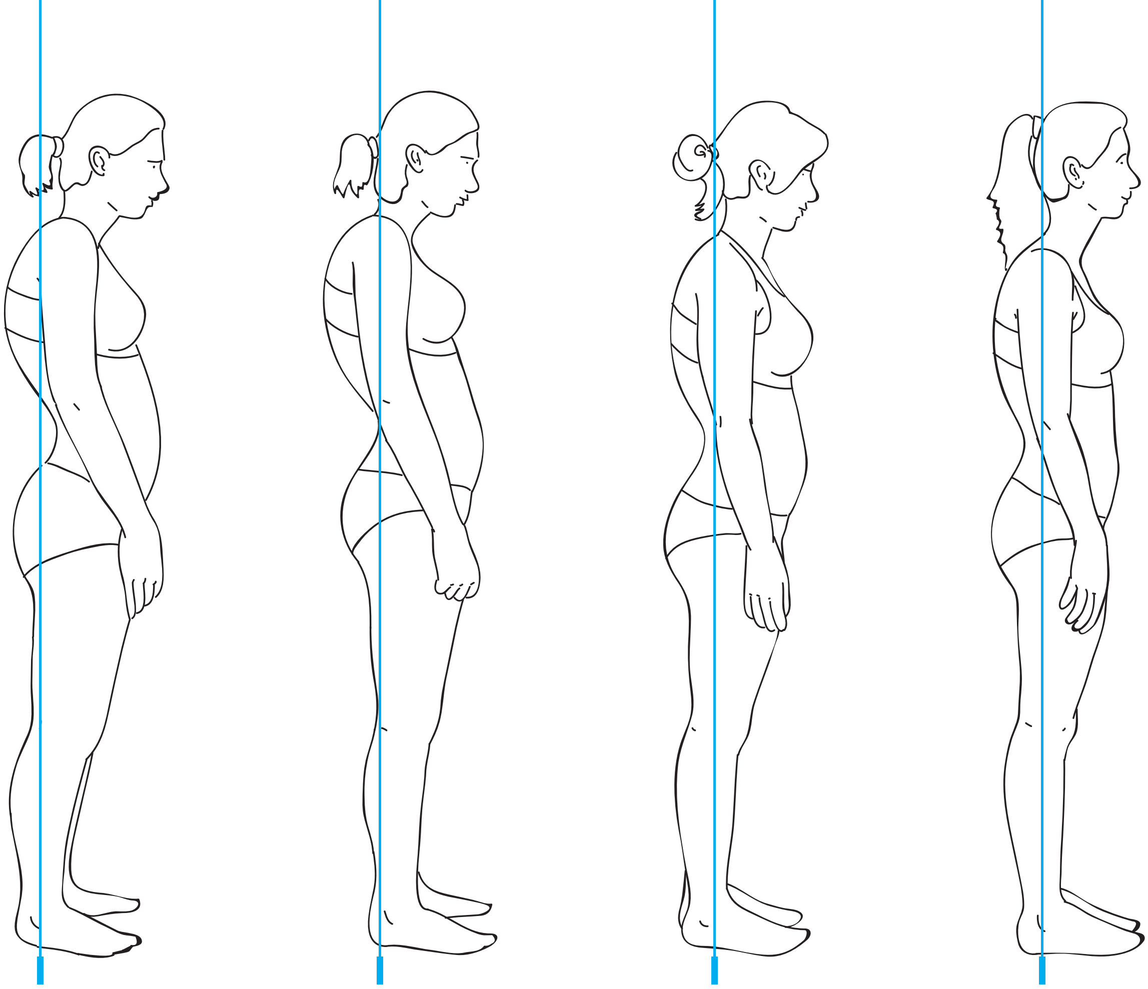
Reflex stimulation

III. Original basic stereotypical movements, which follow:

- Autonomic regulation of the stereotypical gait
- Autonomic regulation of the stereotypical grip
- Autonomic regulation of the stereotypical breathing
- Autonomic regulation of the stereotypical swallowing
- Autonomic regulation of the stereotypical ocular movements.

Like the computer operating system (OS), the human OS has got its “auxiliary system tools” that enable and simplify the running and continuous debugging of the “application programs”.

The operating system of human motor skills is extremely complex, vast and genetically determined for locomotion. And this very vastness requires a period of the first year to let the brain grow and run the program completely. This program is autonomic and independent of the conscious control. Full and correct saving to the “disc” enables the brain to let the human individual implement the ideal autonomic regulation of the posture of the body and the ideal autonomic regulation of the basic stereotypical movements. These building stones of motor skills constitute the precondition for non-complicated learning of other “extension” programs of the fine and gross motor skills.



Before the initiation of the therapy	After three years of therapy

10.1.2 Application programs

User or application programs like Word or Excel make the computer work user-friendly.

BIOS and operating system serve to enable the running of some applications and let us work or play with them. There are hundreds of thousands of application programs and the number is rising.

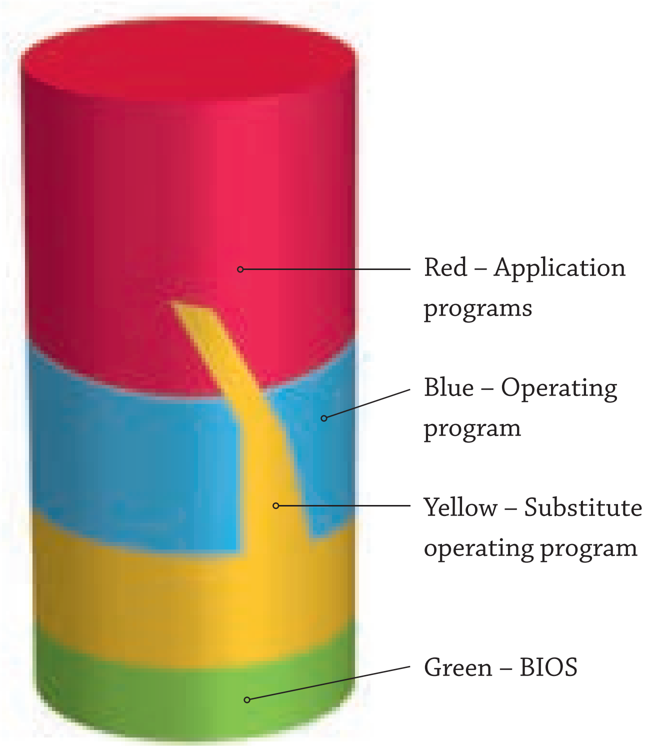
Similarly, the programs of human motor skills have their application programs. They are not innate. We acquire them by learning. Motor learning enables a very rich range of motion of our body. Within the gross motor skills, we can learn many sport activities like throwing, jumping, hitting, kicking etc.

Within the fine motor skills, the range of abilities is even richer – from writing, drawing, painting and fine arts in general to playing very difficult musical instruments. Fine motor skills of the orofacial region enable speech, singing, and playing wind instruments. All these application programs of human motor skills could be further improved by education and maintained up to old age.

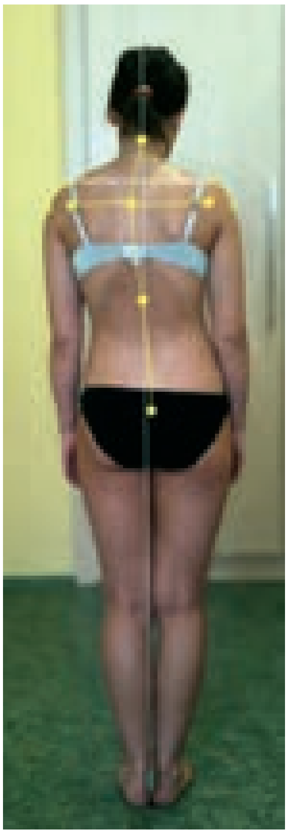
Yet, there is another significant similarity to computer programs. The quality of "the running" of the application programs is utterly dependent on the flawless function of BIOS and the operating system particularly.

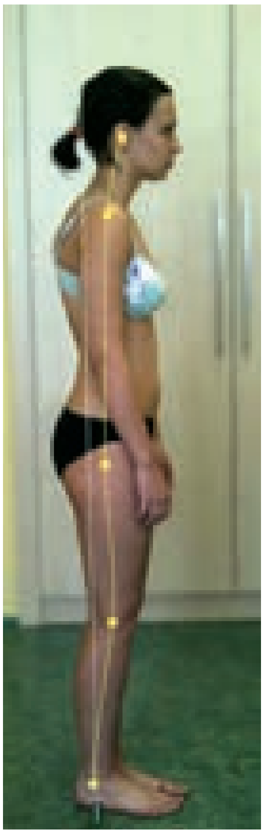
If the operating system of the motor skills of the musculoskeletal apparatus was disturbed anyhow, the learning abilities and the running of any application program would be significantly reduced or completely disabled.

Thus, it is absolutely essential for the quality of human life to have "well-tuned" and flawless operating system.



Depiction of a common situation: the substitute system is not completely "switched off" and interferes with the regulation of the operating system (impairs the autonomic regulation of the posture of the body) and interferes with application programs and restricts their activity.





Now, we have reached a program that doesn't have any direct parallel within the computer world. It is a program we call *the substitute operating system.*

10.1.3
Substitute Operating System – Trend Towards Pathology of Locomotion

During the normal course of the motor development, the substitute operating system occurs only in traces during the first three months. This is a period of so-called "holokinetic motor skills". The infant reacts to stimuli with uncoordinated movements of all limbs. Regulation performed by this program is chaotic. If the "unpacking and launching" of the operating system went well, the substitute system would be switched off and it wouldn't be apparent in the motor skills of the child at about six months of age.

It is kind of a "backup operating program" intended for emergencies, when the operating system has been damaged for some reason. Hence, the substitute program is loaded and launched to an extent corresponding with the damage of the operating system. It could be used only for the control of one limb or of the whole body. A substitute program serves to maintain life. To run the application programs could be significantly more difficult with it or even entirely impossible, no matter if it were the programs of fine or gross motor skills.

There is certain analogy from the world of computers in comparing the current operating systems with the first primitive operating systems like MS DOS. It had no graphical interface and the regimen was based on the user environment represented by a command line – it was simply impossible to click on the icon of a file we wanted to run. Also, it wasn't possible to run the application so simply.

Commands the computer was supposed to perform had to be written in the command line. The commands were combinations of letters and numerals. The essential insufficiency of the DOS program is that the 3D movement of the pelvis against the chest is impossible.

Neurophysiological view of the program for "repair of locomotion"

From a clinical point of view, the individual levels of regulation of the nervous system could be evaluated as follows:

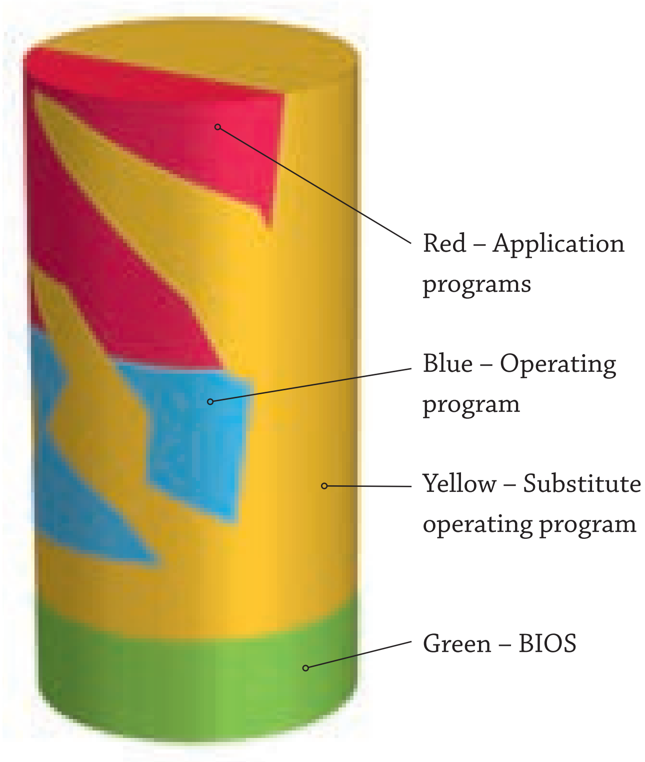
The level of the higher nervous activity that contains the general intelligence, specific motor intelligence, voluntary processes, motivational and instinctive processes, emotional processes, memory processes of remembering and reminding and gnostic functions.

The level of application programs of fine motor skills including oculomotor skills (reading, watching a movie...), phonation motor skills (speech, singing...), facial gestures and orofacial region motor skills and the lingual motor skills (speech, singing, facial expression), motor skills of the hand and fingers (writing, painting, playing the musical instruments...).

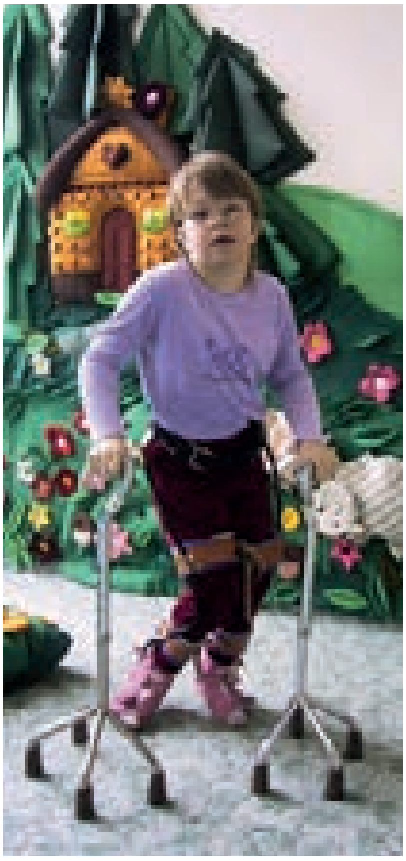
Level of application programs of gross motor skills, e.g. sports, gymnastics, manual working habits, common acting abilities, "bodywork", etc.

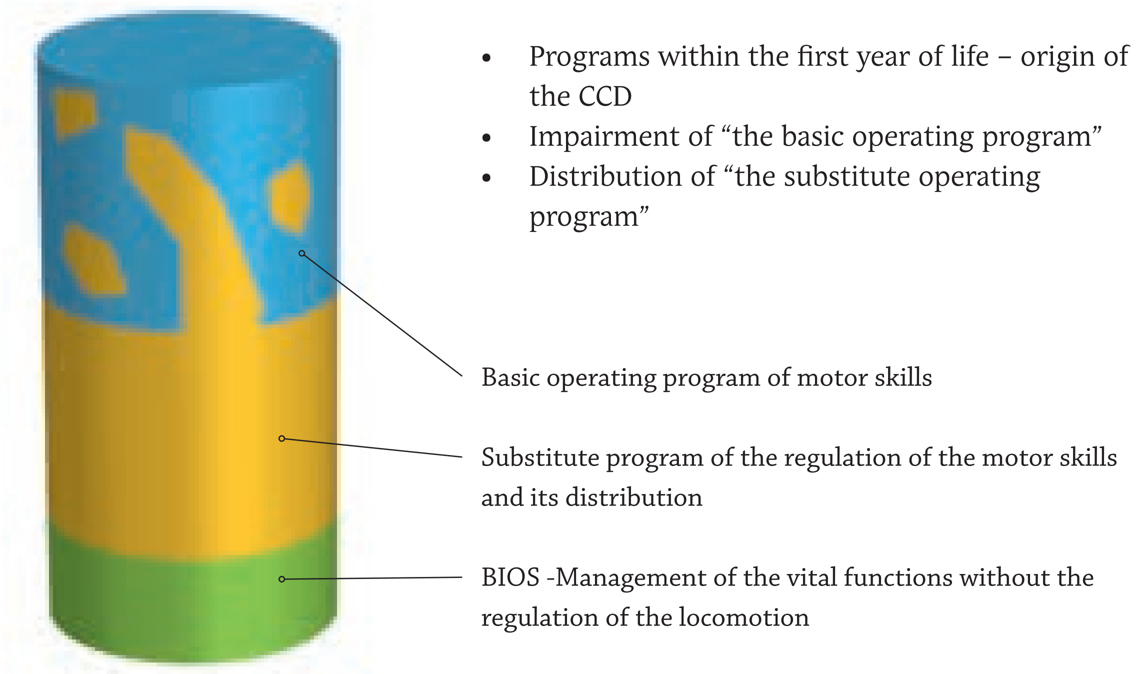
Level of basic operating system of motor skills containing the basic stereotypical gait, basic stereotypical grip, autonomic righting and postural reflexes (postural reactivity), autonomic posture of the body, basic stereotypical respiratory mechanics, stereotypical swallowing and defecation.

Level of substitute operating system of motor skills that enables basal survival with substitute stereotypical movements for the stereotypical



Depiction of a situation of a severe impairment of the operating system, which is largely completed with the substitute program





gait, stereotypical grip, autonomic righting and postural reflexes (postural reactivity), autonomic posture of the body, autonomic respiratory mechanics and autonomic stereotypical swallowing and defecation.

Level of regulation of basal vegetative functions at the level of the brainstem – "BIOS". Cardiopulmonary functions, haemodynamics, regulation of basal metabolism, protective reflexes (cough, sneezing, corneal reflex...).

10.1.4
Repair program

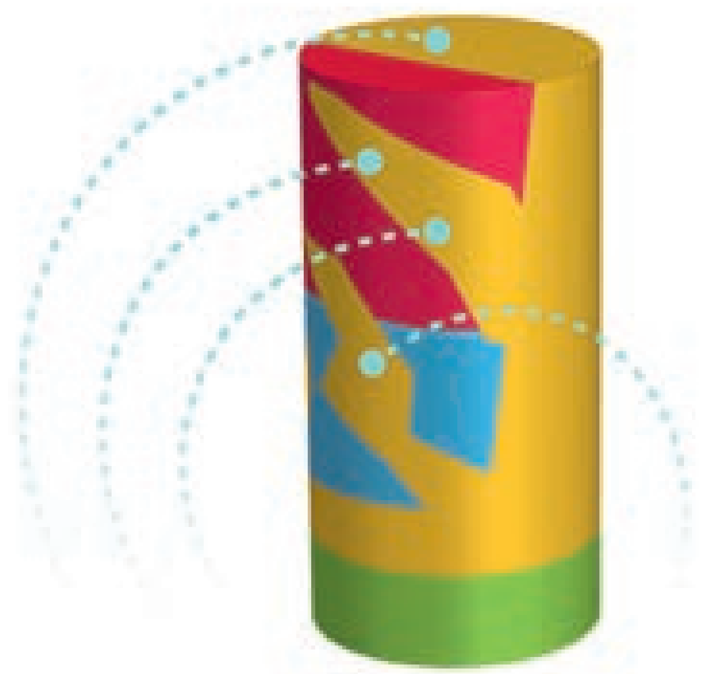
It seems that BIOS contains something like a "program cluster", which is inactive under common circumstances. If its activation was performed in a completely specific way, it could be used as a "repair program" that can reconstruct the *basic operating program of motor skills*. The only known way of such activation is the Vojta methodology of reflex locomotion. I imagine that the repair is implemented by the repair program, which adds the missing "information library" to the undeveloped ("unzipped") operating program. Under physiological circumstances, the OS is loaded during the first year of the ontogenetic development.

Another type of repair could be utilised for damages that have developed in older age despite the aetiology of the impairment.

This specific repair cluster probably contains complete information on the basic operating program of motor skills of the human body in a comprised form. It can be supposed that it also represent "data storage" for "program cores" of application programs and other information from higher nervous activity.

The repaired program in the activated state performs the mapping of the actual condition of the operating program and subsequently,

Neurophysiological view of the program for "movement repair"



- Influence of the reflex stimulation in patients with severe impairment if the basic operating program, e.g. CP, stroke...
- Restitution of the basic operating program
- Disconnection of the substitute operating program
- Improvement of the functions of the application programs

or rather concurrently, it implements the addition of missing "information libraries" and reconstruction or "patching" of the operating program. Concurrently, it performs the complete check-up of the whole musculoskeletal apparatus. "Information files" are stored during the repair process into the cerebral matrix so that they could be used for launching and running of the autonomic regulation of the posture of the body, postural reactivity and autonomic stereotypical gait, grip and other stereotypical movements.

Subsequently, it enables the running of the extension application programs including the programs of higher nervous activity. The clinical launching of the repair program itself is only known through the activation by reflex locomotion (reflex turning, reflex belly-crawling and reflex crawling on all fours).

This activation could be divided to the system of "locks" and "keys".

A system of locks contains the defined positions of the body (of the axial organ and limbs), position of the body in the gravitational field, supporting points or more or less exactly defined supporting surfaces and supporting lines as the case may be.

A system of keys contains the stimulation of defined activation points and zones, the ways of stimulation of these points and zones

Videa
Míša

1. a 2. cvičení
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by pressure, pulling, vibrations in defined vectors and combinations of these activation points and zones and stimulation vectors.

Only if the system of "locks and keys" starts to fit together, the repair program would be activated. During the very "running" of the repair program, the "application programs" of fine and gross motor skills are completely switched off. The centres of higher nervous activity are also gradually "switched off". Conscious processes are inhibited into the relaxed state to the limits of the transition from the conscious state to sleep. Gradually, the centres of conscious proprioception and kinaesthesia switch off to the limits, where the bodily scheme ceases to be perceived.

Activation of the repair program through VM reflex locomotion is completely independent of the function of the higher nervous activity. It is obvious during the therapy of children under one year of age and patients in vigil coma.

The very operating program of motor skills is also utilised during the stimulation by reflex locomotion. All his parts are activated, i.e. the autonomic regulation of the posture of the body, postural reactivity, stereotypical gait, stereotypical grip, stereotypical breathing, stereotypical swallowing and defecation. But all these mechanisms take place in the substitute "economic" mode.

10.2 Case Study – Daniel Pulled out of the Lions' Den

10.2.1 Illustration of the Therapy of the Severe Congenital Developmental Defect of the Brain

Daniel is the third child of our friends Olga and Mirek. We had known them for many years, and


both of their older daughters were in my care. I examined little Daniel at five weeks of age. The results of the examination proved the fears of his parents that there wasn't something right with him. One side of the body showed significant pathological asymmetries in all positions, particularly in the positional tests. Hence, we started the therapy very early. Despite the early commencement of therapy and the intensive home implementation, the lateral asymmetry didn't improve. In his six months of age, Daniel was sent by the paediatrician for neurological

examination, which recommended the examination with magnetic resonance imaging. Daniel went through it in the twelfth month of life. The result was even worse than expected. The description of the magnetic resonance imaging of the brain showed that there was a cortical dysplasia of the right hemisphere with impaired gyrification (pachygyria) and there was also partial widening of the lateral cerebral ventricles. Subsequently, consultation description of the MRI was made in IKEM hospital. It showed even larger impairment. Practically, the whole right hemisphere was affected, particularly its "outer" region (the convexity) of the frontal, parietal and temporal lobe, with an exception of the occipital lobe. Concurrently, according to age, they described retarded myelination of the white matter diffusely in the brain. Among others, the diagnosis was set: "Insufficient presumed normal physiological development of the nervous system – left-sided hemiparesis", i. e. cerebral palsy of the left side of the body.

10.2.2
Clinical Description of the Problem

Brain dysplasia, more recently referred to as malformations of cortical development, is the congenital developmental defect of the brain that originates in the early stages of embryogenesis. This term predominantly describes the disorders of migration and neuronal differentiation. Pachygyria, i.e. excessive thickening of the cerebral gyri, is among the disorders of cell migration and organisation of the cerebral cortex with reduction in the grooves of the cerebral cortex. Approximately 3 % of new-born children are affected by this congenital developmental defect. This count also represents the congenital developmental defects of the brain. Concurrently, these congenital developmental defects, cerebral dysplasia in the strict sense, are often combined with the development of epilepsy and psychomotor retardation. The development of the nervous system is a very complex process, which connects the morphological and functional changes together. Normal development of the individual is dependent on its perfect course. The development is genetically determined by several regulatory genes that encode regulation proteins. Their function consists in stimulating stem cells to proliferate.

Cerebra dysplasia is quite often connected with development of epileptic seizures from the new-born and infant age. (This is relevant predominantly in diffuse disorders of migration that affect large brain areas.) The infants usually develop the seizures presented with flection spasms. Concurrently, the psychomotor development stagnates. In old age, partial seizures caused by the focal cortical dysplasia appear. Pharmacological resistance is common in cerebral dysplasia. Depending on the localisation and extent, cerebral dysplasia relates to various neurological findings (central palsies of cerebral nerves, central hemiparesis in schizencephalia, mental deficit and retardation of the psychomotor development expressed to various extents).

10.2.3
Expert Explanation of the Problem

In Daniel's case, the almost typical development of cerebral palsy could be expected due to clear causes. Undoubtedly proven brain damage caused by the congenital developmental defect would explain the further unfavourable development. It would head towards the symptoms of the hemiparetic type of cerebral palsy with highly probable development of epilepsy and mental deterioration.

10.2.4
Illustration of the Solution

Intensive therapy had been implemented with Daniel since the fifth week of life for five times a day. In the first six months, Daniel's mother could manage the exercises by herself. She and Mirek took turns. Later it was necessary that both were present during the exercise. The training intensified due to the use of a special "training suit" and later of the paediatric rehabilitative bed, and other tools like antiskid mats, lability balls, discs and weights were used. Thanks to these aids, the very exercise was more comfortable and more intensive. Olga and Mirek could evaluate the change in exercise very well as they were experienced because of their daughters' exercise without these aids. This intensive therapy lasted for almost two years. For a long time, it seemed that nothing was happening. Daniel's development shifted forward by almost imperceptible steps, and there were periods of no progress at all. At thirteen months of age, Daniel didn't crawl; he turned around only to one side; he didn't use his left hand as if he didn't know about it. The left lower limb was as though "dead". At about two years of age, Daniel started to get on his knees. Initially he moved forward by hopping and after two following months, alternate crawling appeared. Still, the supporting function of the left hand was significantly reduced. At that time, the intensity of exercises decreased to three times a day with free Sundays. It was a great relief, because both parents were at their wits' end. At two years and four months, Daniel stood up; his first steps started by holding his hand. Over the following two months, Daniel began to walk on his own. His left hand has gradually regained its function, while it was neglected by Daniel for a long time. He hasn't yet used it to grip something.

10.2.5 Explanation of the Solution

The fact that the VM2G therapy began very early after Daniel's birth appeared to be extremely important. Equally, the intensity of the stimulation has been very intensive since the very beginning of the therapy. This has played a key role during the whole process of normalising of the psychomotor development and it has prevented the expected onset of spontaneous brain pulses, i.e. epilepsy. Epileptic seizures significantly worsen the "condition" of the brain and disrupt the reparative processes stimulated by the therapy. Despite the continuous diagnostic results, the expected diagnosis – a lack of, presumed normal physiological development of the nervous system – left-sided hemiparesis – wasn't accomplished. Following the early diagnosis, based on its results, maximal frequency of the performed stimulation has been chosen since the fifth week, i.e. five times a day. Each exercise took thirty-five to forty minutes. After sixth months, both parents participated in most exercises. The stimulation technique was gradually intensified by a special training suit that provided multizonal stimulation. In Daniel's case, there were 21 specifically chosen zones.

The use of the children's rehabilitative table, which allows the performance of VM2G on tilted surfaces, meant another intensification of the stimulation and it happened to significantly enable the implementation of the therapy by parents. Other aids played appreciable role as well – the antiskid mats, labilising discs and balls and limb weights. The goal of this extremely intensive, long-lasting, technically demanding stimulation was to lead Daniel from the realistic and severe threat of congenital developmental defect of the brain – literally, to pull him out of the lions' den. This threat was imminent for more than 2 years. Existing clinical experience shows that these types of congenital defects lead to extremely severe and lifelong handicaps in terms of DMO, epilepsy and mental retardation. We think that the only intensive and higher than average endeavour and self-sacrifice of the parents prevented the pathological development. Only after sixteen months of therapy, the physiological motor development began to accelerate significantly. Bilateral turning occurred followed by righting and crawling on all fours. At the age of two and half, Daniel began to walk. The gait gradually became unaided, balanced and matured in terms of the stereotypical movement. Recently, Daniel has gradually accomplished the therapy, so that he could fully utilise the functions of the left hand. The hand has normal posture without pathological features, with normal joint centration, but it hasn't been completely included into the basic stereotypical grip.

10.2.6 The View of the Possibilities of the Advancement of Motor and Mental Functions in Terms of VM2G in Infant Patients with Congenital Developmental Defects of the Brain with Confirmed Severe Neurological Findings and Very Severe Prognosis Concerning the Upcoming Development

Video

Two and half year old Daniel in the garden

bit.ly/2nWOfit

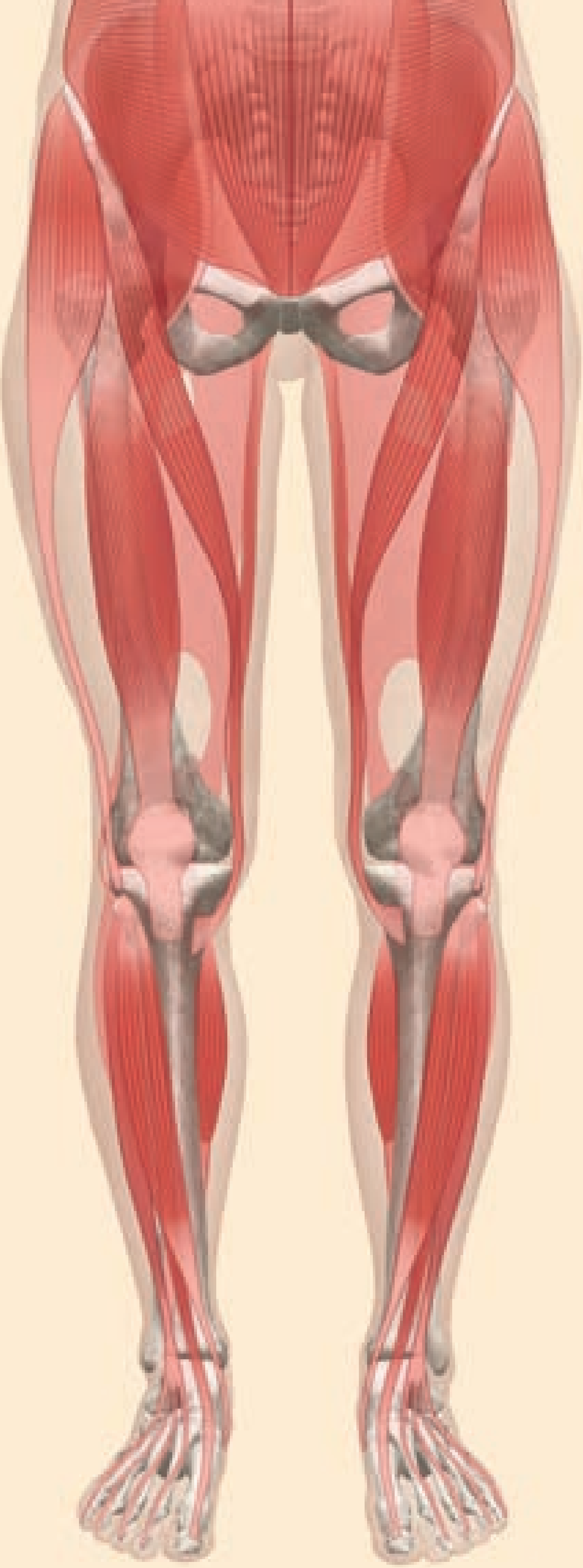
In terms of VM2G, it was revealing that in such severe cases, the course of the therapy is quite different from common "standard" central coordination disorders, even the severe ones. These differences could be seen within the long-term and torpid persistence of primitive reflexes, which prevent the normal physiological development despite the massive therapeutic stimulation. On the other hand, there is still further good news – the stimulations could seem ineffective for several months. The therapy stays in a state of arrested development. It doesn't head in a pathological or physiological direction. In terms of developmental kinesiology, this "static period" is essential because this stagnating phase means that the expected onset of pathological motor skills does not appear. Otherwise, they would inevitably start and would gradually rule over the motor skills of the child after the first year of life, resulting in the definitive stage of some type of cerebral palsy with concurrent epilepsy and mental retardation. It's the phase of stagnation when an intensive therapeutic fight takes place to prevent the pathological course. From the outside, it looks like falling behind. Only after the intensive therapy has set normal conditions in the cerebral matrix probably because of concentration of the neuronal matrix and reaching sufficient "transmission capacity" of the afferent and efferent neural pathways, the normal physiological development could be implemented. It appears in the complete elimination of the primitive reflexes and particularly in the onset of the totally physiological development within its natural phases. This could utterly prevent the development of substitute pathological posture of the body and limbs and the subsequent features of substitute stereotypical movements. I think that the therapeutic stimulation has used the cerebral plasticity that is extraordinary within the early stages. The probable factor explaining the ability of new neuronal formation would be the mechanism of neurotransmitters, which probably initiate the activation of "dormant" stem cells. This launching mechanism would probably explain the primary therapeutic effect of VM2G. It seems that the intensive and long-term brain stimulation is probably the only possible way to secure the neurogenesis, which has been disturbed. The distortion of the normal development of brain tissue relates to another gradual cascading deterioration in time caused by genetically determined apoptosis. Neurons that couldn't be connected into the neuronal networks due to inactivity or hypoactivity are mostly affected by this process of programmed death. Premature utilisation of immature neurons contributes to deterioration of the neurological symptoms. Thanks to insufficient differentiation, these neurons cannot fulfil their expected functional responses within the operation of neuronal networks. This increases the overall havoc in the brain function. This functional and even anatomical chaos is undoubtedly the "breeding ground" for the development of global chaotic discharges, i.e. epilepsy.

Concurrently, these damaged processes of maturation of cerebral tissue are the precondition for persistence of primitive new-born and infant reflexes. This prevents the onset of physiological developmental programs of righting and locomotion. Thus, the gradual development of substitute pathological motor skills evolves.

Dr. Vojta states on the page 350 in the last chapter of his best-known book Cerebral Motor Disorders of the Infant Age,:

> *"There is a certain rule: If a year-long intensive treatment of a child with CP does not show any significant improvement, we must admit, we've reached the limits of the possibilities of our therapy. To make such a conclusion naturally requires great experience and knowledge from the physicians and rehabilitative workers."*

The experience we have gained with VM2G therapeutic approach reaches beyond these limits.



11. View of Human Movement in Terms of Geometry, Mechanics, Biomechanics and Related Kinesiology

11.1 Physiological Biomechanics and Kinesiology of Locomotion

11.1.1 Autonomic Regulation of the Posture of the Body, Righting and Balancing Reflexes

There are certain rules for every forward movement pattern that has developed within the human motor skills, i.e. turning, belly-crawling, crawling on all fours or unaided bipedal gait.

Motor skills of the musculoskeletal apparatus contain the following three inseparable components: the righting and balancing mechanisms that enable the righting of the torso against gravitation and changing the centre of gravity of the torso; balanced autonomic regulation of the posture of the body (postural reactivity); and the phasic motion of muscles with determined angular movement between the segments of the limbs and the axial organ (head and spine), while the angular range during the movement forward is precisely determined in every type of locomotion.

> *Postural reactivity that contains righting and balancing reflexes and the autonomic regulation of the posture are the genetically determined ability of coordinated regulation of the posture of the body. It can be observed from birth. Refer to V. Vojta 1994.[13] "This ability was first described by Arshavski and Krjuchkova (1955, in Kolárova, 1968), who demonstrated, that the new-born can "continuously" turn around in and coordinated fashion, while lying in a supine position in a dark place and being stimulated by a slowly moving light. Thus, it turns towards the light. The new-born watches the ray of light and its body continuously follows from one asymmetrical position to another without a global movement. It's a mirrored and reciprocal activity. Without this knowledge, Arshavski and Krjuchkova demonstrated that a healthy new-born has the ability of coordinated regulation of the posture of the body. The new-born has postural activity. Through their test, the authors proved that the motor course of turning from the back to the side is not learnt motion. They exclusively spoke of the visual orientation of the new-born."*

If there was so-called "holokinetic locomotion" observed in the new-born, it would be a response of the immature CNS to inadequate stimulus and not its ability to regulate the postural activity.

The development of the autonomic posture

← Illustration of the physiological ideal posture of the body in the standing position

13 VOJTA, Václav. Mozkové hybné poruchy v kojeneckém věku. Praha: Grada Avicenum, 1993. ISBN 80-85424-98-3.

of the body, righting and balancing mechanisms in the first year of life is also called *postural ontogenesis*. Its observation is essential after birth, particularly, because from this time on, the child must struggle with gravity.

From the very moment of birth, these innate motor programs have been launched as they enable other movement patterns (stereotypes) to deal with the Earth's gravitation.

The goal of the developmental ontogenesis is to create the ability of the CNS to secure and coordinate adequate posture, upright stance and balance for bodily locomotion from place to place and to adjust to variable situations. This allows the genetically determined basic operating program of motion to be firmly encoded into the connections of the neuronal network of the CNS.

The patterns of posture, upright stance and locomotion from a place could be called *predetermined motion patterns*. Thanks to them, the child learns to recognise the surrounding world. With this precondition, it can subsequently learn the special abilities of fine and gross motor skills.

Posture of the body and movement are mutually dependent on each other. Every change in the position of the body, even a small one, requires the adjustment of the posture of the body to maintain balance.

Vojta principle describes normal legitimate development of movement and the posture of the body (postural development) in a child within the first year of life and subsequently uses it for the diagnosis and the therapy. Normal development of skeleton, fibrous apparatus and fibrous tissue, as well as the development of the muscular apparatus is dependent on the ability of the CNS, in a directly proportional relationship, to develop and establish the basic operating program of locomotion. Without this "software" precondition, the development of "hardware" would be rather irreversibly damaged.

As part of the postural ontogenesis, it is necessary to consider the state of mental

Illustration of the various types of pathological curvature of the spine

development of the child or the level of motor intelligence if applicable. It is directly responsible for the ability of the child to express interest in the outer world and for the ability to adequately react to stimuli. This is called ideomotor skills or motor ideation.

Ideomotor skills are the basic tool for the involvement of all muscles in a myriad of variations. It is related to the actual status of the postural regulation. Differentiation of muscular functions (antigravity, phasic) occurs in every muscle that would participate in the motor development within the postural ontogenesis. Thus, it's the majority of skeletal muscles.

A child that elevates its head while prone and turns it towards an object of interest could serve as an example of functional differentiation. Normal postural activity is the precondition for coordinated rotation of the head, i.e. autonomic regulation of the posture of the body. It is secured by the muscular groups in the cervical and occipital region that raise the head in the elongation of the nape, specifically in the coordination of the dorsal and ventral muscle groups (including hyoid muscles that serve to swallowing with their phasic function). Only after the precondition of such coordinated elevation of the head is fulfilled, the cervical vertebrae are set within favourable biomechanical parameters (extended and centred) and the phasic movement could be implemented, i.e. free rotation of the head to both sides. Automatically set and secured supporting base is the component of the whole process.

11.2 Pathological Biomechanics and Kinesiology of Locomotion

The pathological biomechanics and the kinesiology of the locomotion contain substitute

ILLUSTRATION to definitive pathological posture of the limbs and the body

programs of the body's posture, which intervene with practically all areas of motor skills.

In terms of FUNCTION it recreates:

- Substitute righting and balancing reflexes
- Substitute autonomic regulation of the posture of the body, substitute righting and balance reflexes
- Pathologically changed basic stereotypical movements
    - gait mechanism
    - grip mechanism
    - stereotypical breathing
    - stereotypical swallowing, etc.

In terms of MORPHOLOGY, it induces the disorder of:

- Ontogenesis of rotatory directions in the limbs
- Ontogenesis of curves of axes of the axial organ
- Ontogenesis of forming of the ribcage
- Ontogenesis of creation of bearing arches of the feet and the posture of the toes
- Ontogenesis of development of the hip joints
- Ontogenesis of development of the shoulder girdle, arm and hand

Illustration of the pathological posture of the chest – pigeon chest

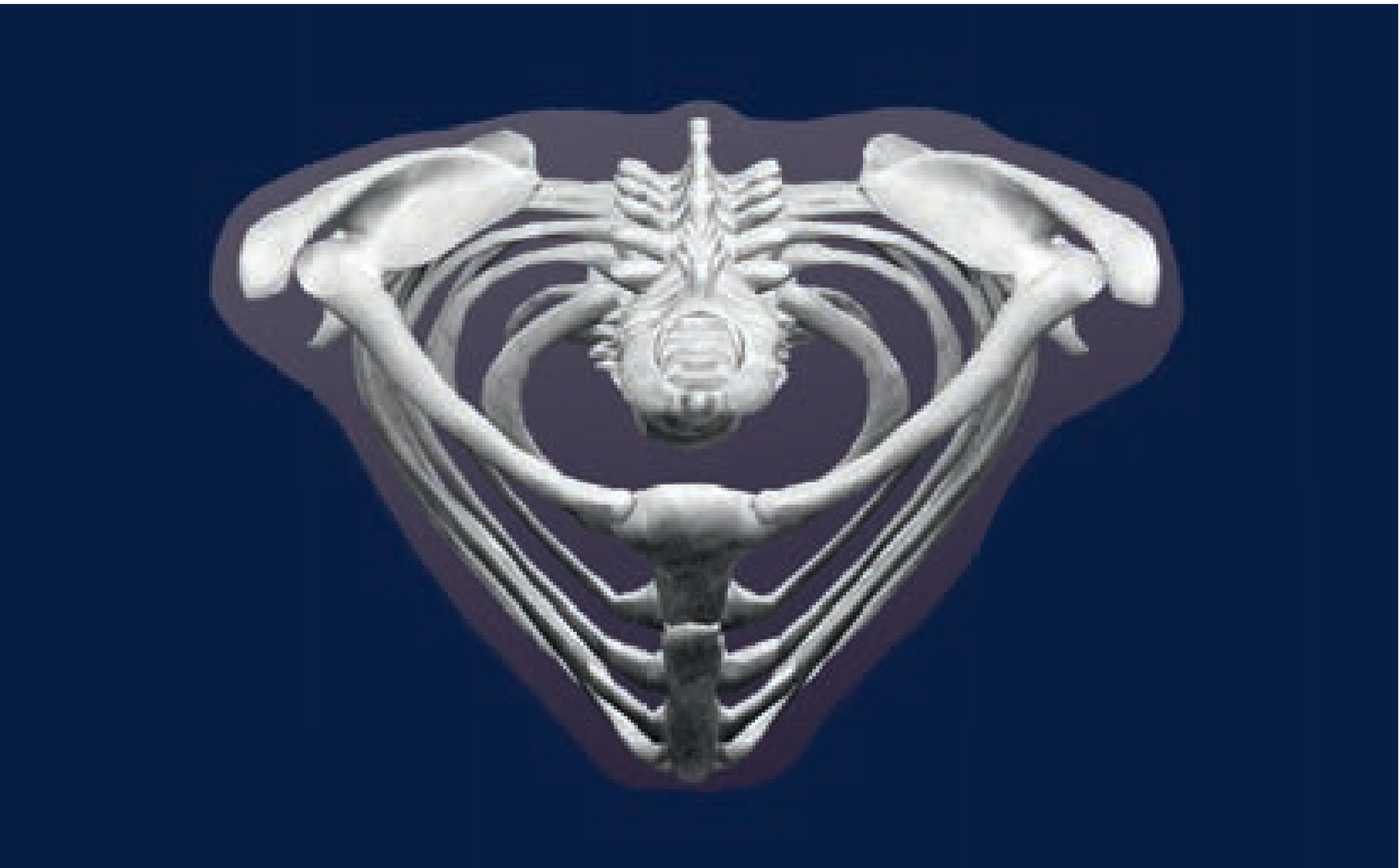


Illustration of the pathological posture of the foot with collapsed longitudinal arch and hammer-shaped posture of the 2nd toe

Illustration of the pathological posture of the foot with collapsed longitudinal arch and hammer-shaped posture of the 2nd toe

Illustration of the pathological posture
of the chest – pigeon chest

- Ontogenesis of development of posture of the pelvis
- Ontogenesis of development of the leg and foot
- Ontogenesis of development of the posture of the head and mandible

The development of the many pathological disorders of the musculoskeletal apparatus in children and adults could be traced back to the period of early ontogenesis of the development within the first year of life. Imperfect posture of the body is a typical impairment manifested in an inadequate or absent righting function. The more severe the impairment is, the more the primitive patterns of posture dominate, and the pathological substitute patterns develop.

Disharmony that develops during the postural righting ontogenesis always projects itself into the targeted phasic gross and fine motor skills. In terms of CNS regulation, the disorders manifested at the level of dysfunction, e.g., mild brain dysfunctions and specific learning disorders (dysgraphia, dyslexia, etc.) represent disorders of central coordination of highly specific fine motor skills. In a certain sense, we can say that these coordination disorders subsequently manifested themselves in intellectual activities. The activity of oculomotor muscles, vocal apparatus and the small muscles of the hand could be classified as highly specific motor skills.

For the normal activity of these muscle groups and their activities, the standard function of the gross motor skills is necessary, including the autonomic regulation of the posture of the body, righting and balancing reflexes.

In children that suffer from the above-mentioned specific disorders, we necessarily find impairment of central coordination during the examination of the musculoskeletal apparatus. They are seen in the incorrect posture of the body and impaired basic stereotypical gait, grip and breathing.

Blockages that prevent the development of the normal righting mechanisms with balancing reactions are responsible for many disorders of the skeleton of the musculoskeletal apparatus itself and the disorders of phasic motion within both basic stereotypical movements and the application programs of gross and fine motor skills, and also the disorders that are not so obviously related to locomotion such as the specific learning disorders.

When evaluating the development of many disorders it is necessary to understand that the existing genetic program is ready to participate in postural ontogenesis. But the blockages of various aetiologies cause the program to be, partially or fully, inaccessible to central neuronal networks. Consequently, the incorrect function of the motor skills themselves occurs and the whole development of the skeleton is deviated. A child affected with central coordination disorder can't adequately respond to stimuli from its surroundings, which would normally arouse its curiosity and attention because the CNS cannot offer suitable motor skills. If the function of postural and phasic motor skills was impaired, the child would be in danger of remaining in its substitute stereotypical movement patterns, which would damage the postural development.

Trophic features and the development of the limbs are directly dependent on the posture of the body or the normal function of the program of postural ontogenesis as the case may be. This fact is obvious in, e.g., expressed syndromes of infantile diparesis and hemiparesis that are commonly related to the hypoplasia of the paretic limbs. Hypoplasia is also common in postpartum brachial plexus palsy.

Functional and morphological disorders are usually interconnected. That's why, e.g., a disorder of autonomic posture of the pelvis manifests within the overall autonomic posture of the body in impaired posture of lower limbs, shoulder girdles and other bodily parts.

Animation

Interlinking of the impaired autonomic regulation

bit.ly/2lipngQ

bit.ly/2m9Mhq3

12. Practical Part – VM2G – Aetiology of the Disorders And Their Diagnosis

Aetiology of the impairments of the musculoskeletal apparatus is based on

- Disorders of the regulation of the muscle tone
- Disorders of the regulation of the axes of the body
- Disorders of the regulation of the joint centration
- Disorders of the regulation of the muscle coordination of the motion

Aetiology of the impairments of the musculoskeletal apparatus that developed postnatally

- Developmental disorder of the musculoskeletal apparatus in childhood
- Subsequent developmental disorders of the musculoskeletal apparatus
- Functional disorders of the musculoskeletal apparatus in adulthood
- Posttraumatic and postoperative disorders of the musculoskeletal apparatus in children and adults

12.1 Early Diagnosis of the Imminent Developmental Disorders of the Musculoskeletal Apparatus in the First Year of Life

The first year of development of the musculoskeletal apparatus is extremely important, and the consequences of the impairments that could occur in this period would in actuality impact on the whole future life. Therefore, it is meaningful to carefully monitor the development in this period.

There are several evaluation scales of motor development in the first year of life. It turns out that the one created by V. Vojta is very suitable. It's important to mutually compare **spontaneous locomotion, elicited locomotion in positional reactions and the reactions within reflexes at the new-born and infant age.** All three components should be related to the actual age of the child.

Like Dr. Vojta, Prof. Prechtl [14] described that children with a high risk of developmental defects present themselves differently in terms of spontaneous locomotion than children undergoing normal development. His diagnostic methodology confirms the significance of monitoring spontaneous locomotion of infants. He called it "evaluation of general movement" (1990). During the last 25 years, it's been demonstrated that the GM patterns represent sensitive indicators of some neurological disorders and they have been compared to a "window" into the developing brain.

14 EINSPIELER, Christa. Prechtl's Method. Arend F Bos, Fabrizo Ferrari & Giovanni Cioni. 2004. ISBN 1 898683 40 9

12.1.1 Monitoring of the Spontaneous Development

Permanent regulation is necessary in the position on the back, on the side, semi-sitting position on the side, when supported on hands and when standing on two feet.

Every instance of standing upright and locomotion requires autonomic regulation of the posture of the body just as the spontaneous locomotion of the child requires spontaneous motor skills. The posture related to the spontaneous motor skills has been carefully analysed and described by Dr. Vojta, Prof. Prechtl and others.

These basic concepts allow for the correlation of the exhibited locomotion the child with the corresponding posture of the torso.

Analysis and evaluation of the spontaneous motor skills of the child serves to estimate its *motor developmental age*. Therefore, it is particularly important to observe the movement patterns the child can do. The evaluation of movement patterns should be oriented to the patterns implemented by approximately a half of the normally developing children in the first year of life. They serve as an approximate measure for evaluation of quality related to the physiological posture of joints and predominantly the functional patterns of muscles or alternatively their regulation. Deviations from normal development can be monitored quantitatively (number and frequency of movements) and qualitatively (vehemence, inadequate expansion, overall tension and motor discoordination)

To apply the Vojta method in children at the first year of age with motor disorders of various aetiologies requires the authorised therapist to know these developmental motion patterns.

Their knowledge is necessary for the assessment of the initial values for quantitative (what does the child do?) and qualitative (how does the child do it?) evaluation of the autonomic posture, righting and postural reflexes as well as the phasic motion of the examined child.

Video

Timely diagnosis of infants

Stanislav
bit.ly/2notXtd

Toníček
bit.ly/2nIZaek

12.1.2
To assess the results of observation of the spontaneous locomotion of the infants, it is appropriate to distinguish several evaluated regions:

- Observation of the spontaneous locomotion of the whole body in the supine position
    - Observation of the posture of the head
    - Observation of the posture and movements of the arms
    - Observation of the posture and movements of the legs
    - Observation of the posture of the pelvis
    - Observation of the supporting base of the body
- Observation of the spontaneous locomotion of the whole body in prone position
    - Observation of the posture of the head
    - Observation of the posture and movements of the arms
    - Observation of the posture and movements of lower limbs
    - Observation of the posture of the pelvis
    - Observation of the supporting base of the body and supporting points
    - Assessment of the stereotypical breathing
- Assessment of the stereotypical turning
- Assessment of the stereotypical crawling and crawling on all fours
- Assessment of the stereotypical of upright stance and quadrupedal gait
- Assessment of the stereotypical gait and grip

12.1.3
Observation and assessment of elicited locomotion and positional reactions

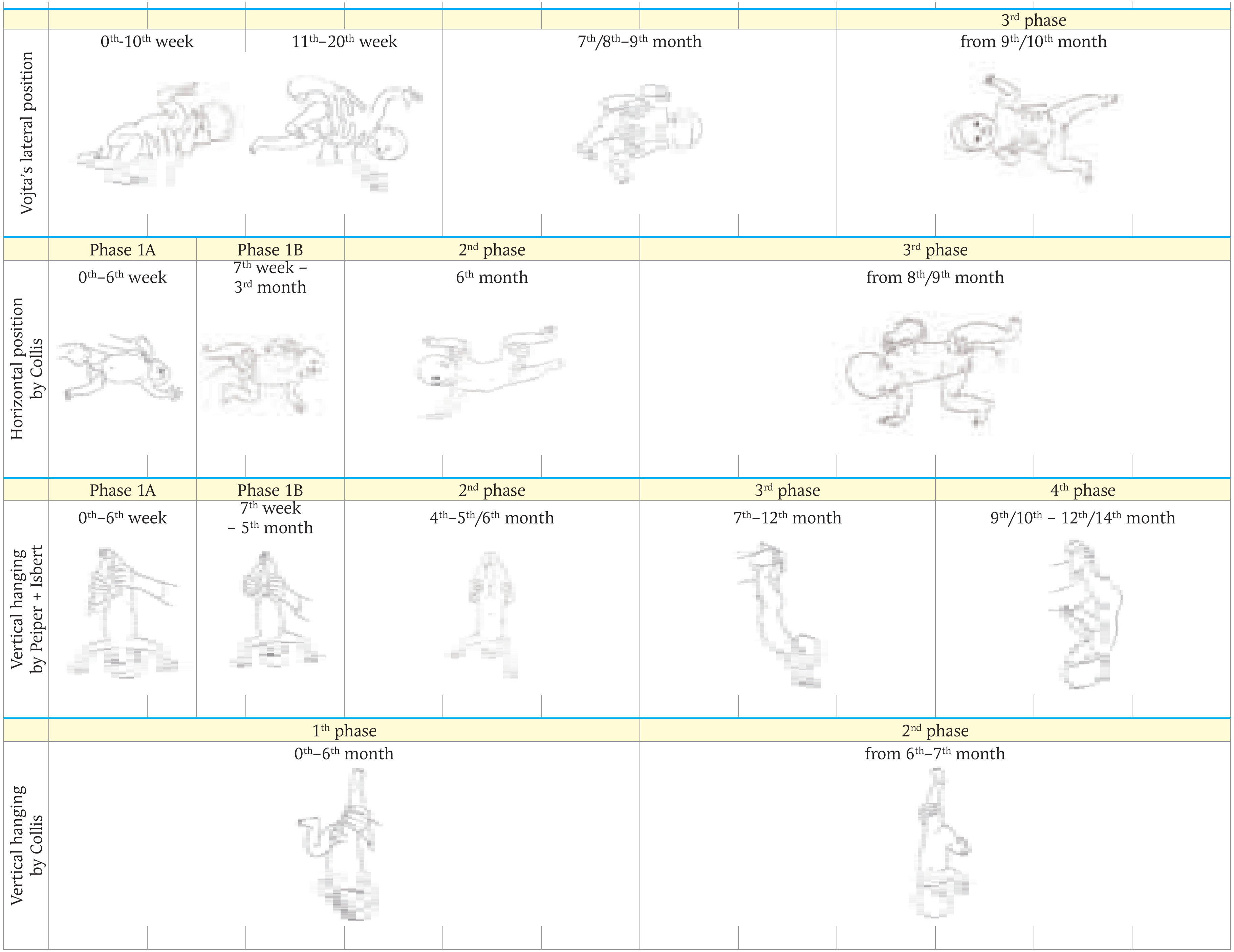
Either positional reactions were a genius idea, or Dr. V. Vojta was a genius himself. Since the mid-fifties, Dr. V. Vojta had been looking for a way, how to early identify the risk of pathological development of motor skills in infants. It was known at that time that children who developed cerebral palsy showed some abnormalities, which were observed by their mothers and paediatricians during the first year of life. Nevertheless, it was impossible to assess,

Video

Timely diagnosis of infants

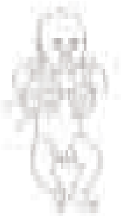
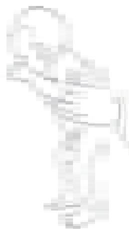
Anička
bit.ly/2oqT68r

Michael
bit.ly/2oqT68r



Vojta's lateral position
0th-10th week
11th–20th week
7th/8th–9th month
3rd phase
from 9th/10th month
Horizontal position by Collis
Phase 1A
0th–6th week
Phase 1B
7th week – 3rd month
2nd phase
6th month
3rd phase
from 8th/9th month
Vertical hanging by Peiper + Isbert
Phase 1A
0th–6th week
Phase 1B
7th week – 5th month
2nd phase
4th–5th/6th month
3rd phase
7th–12th month
4th phase
9th/10th – 12th/14th month
Vertical hanging by Collis
1th phase
0th–6th month
2nd phase
from 6th–7th month

Table – Positional Reactions

<table>
<tr><td rowspan="2"></td><td colspan="3">1st trimester</td><td colspan="3">2nd trimester</td><td colspan="3">3rd trimester</td><td colspan="3">4th trimester</td></tr>
<tr><td>1st month</td><td>2nd month</td><td>3rd month</td><td>4th month</td><td>5th month</td><td>6th month</td><td>7th month</td><td>8th month</td><td>9th month</td><td>10th month</td><td>11th month</td><td>12th month</td></tr>
<tr><td></td><td colspan="2">Flection Stage</td><td colspan="2">Extension Stage</td><td colspan="4">Flection Stage</td><td colspan="4">Extension Stage</td></tr>
<tr><td>Traction test</td><td colspan="1.5">0th–6th week
</td><td colspan="1.5">7th week –
3rd month
</td><td colspan="3">4th–6th month
</td><td colspan="3">7th–8th month
</td><td colspan="3">9th/10th – 12th month
</td></tr>
<tr><td></td><td colspan="1.5">1th phase</td><td colspan="2.5">2nd phase</td><td colspan="8">3rd phase</td></tr>
<tr><td>Landau test</td><td colspan="1.5">0th–6th week
</td><td colspan="2.5">7th week – 4th month
</td><td colspan="8">5th – 12th month
</td></tr>
<tr><td></td><td colspan="3">Phase 1A</td><td colspan="4">Phase 1B</td><td colspan="5">2nd phase</td></tr>
<tr><td>Axillar hanging</td><td colspan="3">0th–3rd month
</td><td colspan="4">4th–7th month
</td><td colspan="5">from 8th month
</td></tr>
</table>

whether the development of the individual child would be pathological or not.

Neurological reflexes show the abnormalities, but basically, they cannot sufficiently predict the upcoming pathological development. It was the extensive work of Dr. V. Vojta that let him create a screening set, which would enable such prediction. Most of the positional tests had been known since the mid-twentieth century, but what Dr. V. Vojta essentially did was arrange the results of the test into a timeline. That's how the table of positional reactions was made. It was first published in 1972. Many trials have demonstrated that "Vojta screening" has high sensitivity and specificity and can be clearly recommended in diagnosis of developmental disorders of motor skills.

According to this table, it could be determined, what is the "actual" status of the development of the child, i.e. whether his responses in individual positional tests correspond with the normal results in the respective age or whether they deviate. According to the number of deviated responses, it could be estimated whether the child was healthy or whether his motor development was at risk to some degree. The number of abnormal responses determines the level of risk. If the motor development were endangered, we would talk about the so-called "Central Coordination Disorder" (CCD), which is not a definitive diagnosis. It is an evaluation of the condition, which is important for the decision on the necessity of either therapy or alternatively careful monitoring. It is necessary to start the therapy in children who show signs of mild CCD.

- Mildest CCD 1-3 abnormal responses in positional tests
- Mild CCD 4-5 abnormal responses in positional tests
- Moderate CCD 6-7 abnormal responses in positional tests
- Severe CCD 7 abnormal responses in positional tests with concurrent severe tone disorder

Of course, the tests serve as a very good indicator on the course of the therapy and on the success of leading the child towards normal motor development. If a child with signs of severe CCD started the therapy, the number of abnormal responses should decrease with correct therapy. Thus the degree of CCD gradually decreases to normal.

Video

Timely diagnosis of infants

Kateřina
bit.ly/2nJ0EVR

Anna
bit.ly/2nTZEyt

Assessing the degree of CCD is not only a result of positional tests that are very sensitive to evaluation of the condition, in which the brain of the child is. The reaction to primitive reflexes and the assessment of the spontaneous locomotion of the child should also be considered. This complex view is sufficient to decide whether it's necessary to initiate the therapy.

Observation of these functional relations allows the therapists to assess the child's overall condition within its spontaneous sensorimotor expressions. Concurrently, incorrect patterns could be revealed before they could significantly manifest themselves in the upcoming development. These findings constitute the goals of the therapy.

Video

Timely diagnosis of infants

Doris
bit.ly/2oqOSOc

Vojtěch
bit.ly/2nTQbY2

Position and reaction merge in the term *positional reaction*. Position means the position of the body, and reaction means the response to the change of the position of the body induced by the therapist. Reactions are presented within the patterns of posture and locomotion. Positional reactions could be considered as the key to the innate movement programs. Every positional reaction consists of a set of stimulations, by which the therapist stimulates the CNS to certain responses.

Initiation of positional reactions happens in a previously determined standardised way by changing the position of the infant's body. This releases many impulses from tension receptors of the muscles, tendons, fasciae, joints, joint capsules and ligaments. The impulses also stimulate the receptors of the thoracic and abdominal cavity and the telereceptors. The vestibular organ of the inner ear is concurrently stimulated by continuous change in the body position. During the standardised performance of the positional reactions, *the sum of these various impulses* leads to their constant input into the regulatory levels of the spinal cord and the brain, also in repeated examinations. The ability of CNS to regulate certain motor patterns in a coordinated fashion constitutes the response.

Processing of the impulses in the CNS is manifested in the responses to individual changes in position. The explanation is that the brain always responds in general and can reorganise itself continuously. Vojta called this complex course as *postural reactivity*. It stands behind the ability of the CNS to respond to the above-mentioned impulses with corresponding reactions of posture and movement within pre-set positions.

The CNS of a healthy new-born has the possibility to control the patterns of posture and motion after certain stimulation. They are relevant for the whole body and can anticipate the existing development of the posture of the body with positional reactions described by Vojta, which couldn't be spontaneously performed by new-borns yet.

12.1.4
Central coordination disorder. Quantitative assessment. Indications for therapy. Vojta, 1991.

% Children	Number of abnormal positional reactions	Spontaneous normalising	Possible pathology	Central coordination disorder	Indication for treatment with reflex locomotion
0.5 %	7	10 %	90 %	Severe	Always
3-5 %	6	45 %	55 %	Moderate	Always
25 %	1/3 4-5	75 %	25 %	Mild	In asymmetry
	2/3 1-3	90 %	10 %	Very mild	Check-up
70 %	0	100 %	0 %	Normal	0

12.1.5
Observations and evaluations of the responses within the reflexology of newborns and infants

Table 2. Dynamics of primitive reflexes (first trimester) (5).

Primitive reflexes	Physiological presence	Pathological syndrome
Babkin reflex	0-4 weeks	after 6 weeks
Sucking reflex	0-3 months	after 6 months
Acoustic facial reflex	From 10th day	negative in 4th month
Walking automatism	0-4 weeks	after 3 months
Support reaction on upper extremities	Always pathological	from birth
Support reaction on upper extremities	0-4 weeks	after 3 months, eventually after birth
Suprapubic reflex	0-4 weeks	after 3 months (spastic risk)
Crossed extension reflex	0-6 weeks	after 3 months (spastic, eventually dyskinetic risk)
Heel reflex	0-4 weeks	after 3 months
Hand root reflex	Always pathological	from birth
Galant reflex	0-4 months	– reduced or absent in the 1st trimester – increased since 2nd trimester
Reflex grip		– reduced or absent in the 1st trimester on hands and feet
With hand	until the development of the grip hand function	– reduced or absent in the 1st trimester in dyskinetic risk – increased since 2nd trimester in spastic risk
With foot	until the development of the supporting role of foot	– reduced or absent in 2nd and 3rd trimester, eventually later in spastic risk – increased or absent in 2nd and 3rd trimester, eventually later in dyskinetic risk

To achieve precise diagnostic technique, recording the examination of infants on the computer with webcam was proved to be useful. Retrograde analysis of both the spontaneous locomotion and the course of the reactions helps to recognise the level of development correctly. Records obtained over several months can easily demonstrate, whether the therapeutic interventions really lead to normalisation of the motor development of the child.

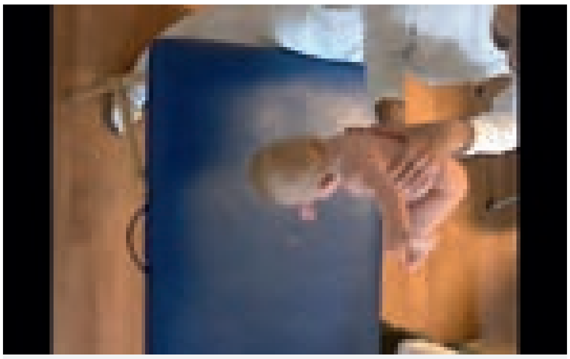
Motor analysis is an inseparable part of the assessment of the development of the child. It largely consists of the *assessment of the posture*, which only enables the movement (postural ontogenesis). Posture of the torso is assessed in relation to movements of the limbs and the head. Observations of these functional relations allow the therapists to evaluate the child in general within its spontaneous sensorimotor expressions and possibilities. Thus, it allows the discovery of false patterns that would be insufficient for further development. These findings can lead to determination of the backgrounds and goals of the therapy.

Long-term practice shows that the elaborated guidelines for general practitioners for early identification of the initial motor and posture disorders and the cerebral palsy especially were flawed.

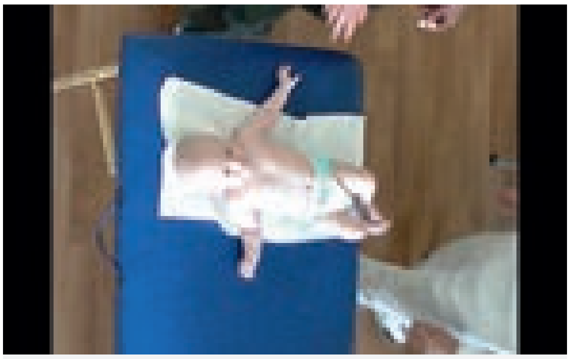
Reflexes	Extinction Period	Technique of Performance
Babkin reflex	4 weeks	Pressure on the palm induces opening of the mouth and sometimes even turning of the head towards the stimulation.
Suprapubic reflex	4 weeks	Pressure on symphysis induces extension of both lower limbs.
Puppet eye phenomena	beginning of fixation	Repeated passive rotation of the head to both sides in supine position, eye bulbs turn to the opposite side.
Crossed extension reflex	6 weeks	Triple flection of the lower limbs evokes extension of the other lower limbs.
Gait automatism	1–2 months	Tilting the child forward in a vertical position and rocking and turning it to its sides induces movements resembling gait.
Reflex crawling	2 months	Exteroceptive skin stimulation on soles in prone position induces coordinated rhythmical movements of the lower limbs.
Suck reflex, swallowing reflex	2–3 months	Stimulation of the tongue, the palate or the lips induces sucking and rhythmical swallowing.
Search reflex	2–3 months	Soft touch of the skin near the mouth angle induces turning of the head towards the stimulus and opening of the mouth.
Fencing reflex	2–3 months	Rotation of the head to one side induces extension of the mandibular limbs and flection of the occipital limbs.
Galant reflex	2–4 months	Tactile stimulation paravertebrally in the lumbar region induces turning of the torso with the concave curve on the side of the stimulation.
Moro reflex	3 months	Detailed description below – refers to pain and startle reactions.
Reflex grip on upper limbs	accomplishment of a hand grip (4–6 months)	Soft pressure of the examiner's fingers on the palm of the child (without touching the back of the hand) induces flection of all fingers.
Reflex grip on lower limbs	accomplishment of the supporting function of the foot (9–12 months)	Pressure on the sole at the metatarsophalangeal region (without touching the back of the foot) induces plantar flection of all toes.
Plantar (Babinski) reflex	12 months	Tactile or slightly painful stimulation of the sole from the heel to the toes over the fibular margin evokes dorsal flection of the toes.

Video

Timely diagnosis of infants



Barbora
bit.ly/2nVkeyG



Karolína
bit.ly/2olQpbl

According to these guidelines[15], the general practitioner for children and adolescents performs the screening of the psychomotor development "**according to Vlach**".[16] This type of screening **doesn't have sufficient predictive sensitivity**. Children at risk of motor disorder aren't usually identified by the first line physicians in time. Consequently, the adequate rehabilitative care comes too late and the chances of normalisation of their motor development are wasted.

The above-mentioned guidelines recommend that the screening of the postural development "according to Vojta" in all children at risk and in children suspected from retardation of the psychomotor development should be performed by paediatric neurologists, paediatricians specialised in diagnosis of early motor disorders or rehabilitation physicians and eventually physiotherapists.

Thus, the children get to specialists that can perform early diagnosis of infants at risk of pathological motor development later than desirable.

In common practice, a child in which the paediatric practitioner didn't identify the risk of pathological motor development through routine examination is being recommended to the facility of a paediatric neurologist too late. The neurologist identifies the disorder and sends the child to the physiotherapeutic facility. Thanks to long waiting lists at these facilities, the child doesn't receive therapy in time.

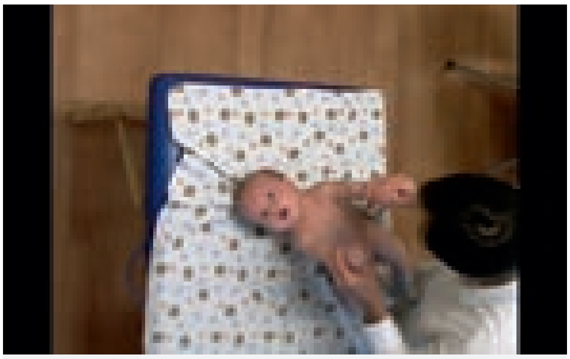
Best results are achieved in children, who, due to early diagnosis, got the early therapy and the intensive care was initiated from the 3rd month or earlier. The later the diagnosis is performed and the therapy initiated, the more the chances of future flawless development of the child decrease. Commencement of therapy in later months is significantly more demanding for all involved. The child could start to manifest the substitute pathological motor skills, if only slightly indicated. Their elimination is more difficult therapeutically. Moreover, the child tolerates the intensive and regular therapy with problems.

15 Reg. č. o/101/218, Dětská mozková obrna Autor: Doc. MUDr. Vladimír Komárek, Spoluautor: MUDr. Jan Hadač, Nařízení DOPORUČENÉ POSTUPY PRO PRAKTICKÉ LÉKAŘE – Reg. č. o/101/218, http://www.cls.cz/dokumenty2/os/t218.rtf

16 VLACH, V., ČIPEROVÁ, V. Screeningové vyšetření psychomotorického vývoje kojence. Čs Pediat, 1972, 27, s. 351-354.

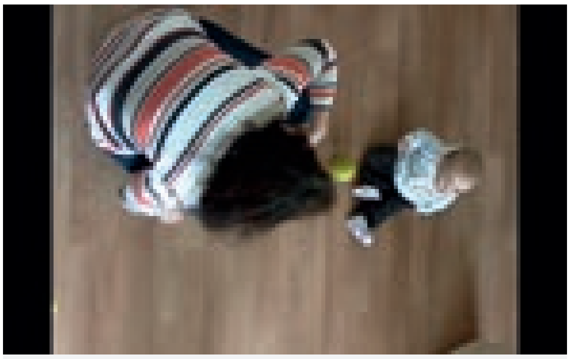
Video

Timely diagnosis of infants



Filip

bit.ly/2omecIv



Tereza

bit.ly/2osgSRg

For parents, the initiation of the therapy either in 3rd or 9th month makes a significant difference. The late initiation of the therapy is very complicated for physiotherapists, too. They know that the conditions for the normalisation of the motor functions of the child are far from optimal and that the time remaining for the intensive therapy is shorter. The summary of all these factors is stressful and may lead (and sometimes does, unfortunately) to unfavourable results and to the impairment of the child. The window of **"therapeutic opportunity"** opens right at the beginning of the child's first month of life and it closes gradually with the accomplishment of the development of the basic programs of motor skills, i.e. from the twelfth to the fifteenth month of life of the child. In this period, the process of synaptogenesis is highly active and allows easy "repairs" of the cerebral "hardware" within the neuronal plasticity of the brain tissue, and the "installation" and normal function of basic programs of motor skills in particular.

This situation was well described by P. Borys[17] (2010) *"Many of the children that suffer from neuro-motor problems could have been cured in their infancy!"*

The experience form the previous twenty years indicate (Kolář 2009)[18] that omitting the early diagnosis leads to problems within the disorders of gross motor skills like cerebral palsy, but far more often missed detection and failing to notice the warning signs in the first year are manifested in several subtler neuro-psychological disorders.

Understanding the early diagnosis by Vojta is closely related to understanding the developmental kinesiology of the child. Only through the interplay of this knowledge can a qualified assessment of the obtained diagnostic data be performed. The very performance of the early diagnosis requires obtaining the manual dexterity and physical skills that would allow sufficiently quick and safe manoeuvres of the positional tests. Only the repeated practical training ensures the manual skills in the treatment of the child and the ability to "read" the reflex responses quickly. Recording of the examination on the webcam has proved to be a great aid for training and

17 BORYS, Przemyslaw. MODEL OF THE NEWBORN'S PHYSICAL DEVELOPMENT. Acta Physica Polonica B . May2010, Vol. 41 Issue

18 KOLÁŘ, Pavel. Rehabiltiace v klinické praxi. Praha, 2009, Galen, ISBN 978-80-7262-657-1

Video

Timely diagnosis of infants

Adéla

bit.ly/2nTL9e3

Antonín

bit.ly/2oqVADM

for long-term monitoring of the development of the in the field. It allows later evaluation of spontaneous locomotion and of the reactions to the positional tests of the child at rest and with the possibility of comparing the reactions and conditions of spontaneous locomotion from the previous examinations. Moreover, the recording may be important because of legal issues.

Diagnosis of the Disorders of the Musculoskeletal Apparatus in Walking Children and Adults

12.1.6
Static Assessment of the Standing

- Axes of the standing body
- Configuration of the pelvic girdle and the lower limbs
- Axial organ
- Configuration of the girdles of the upper limbs
- Posture if the head and mandible
- Assessment of the patient in the supine position
- Axes of the lower limbs
- Axes of the upper limbs
- Configuration of the ribcage
- Abdominal wall

12.1.7
Dynamic Assessment of the Basic Stereotypical Movements

- Assessment of the stereotypical breathing
- Assessment of the stereotypical movements in the orofacial region
- Assessment of the stereotypical gait
- Assessment of the stereotypical grip

Video
Timely diagnosis of infants

Šimon
bit.ly/2oJF9lw

Amálie
bit.ly/2nKqvfZ

13. VM2G – Basic Principles

VM2G is founded on several principles that include the knowledge of the motor program, understanding of the spiral motion dynamics, awareness of the determining force and velocity momentums within the course of the movement itself and comprehension of the movement trajectories that run in the spiral dynamics. They have a unique course determined by the biomechanical relations within the musculoskeletal apparatus and are unchangeable in every individual.

The goal of VM2G therapy is to intervene in the organisation and the functions of the CNS, so the patients could use genetically inserted motor programs that haven't been accessible because of a motor disorder.

Through VM2G therapy, innate motor programs are activated. These motor programs are variable and can be combined. Different functional relations between the musculoskeletal system and the sensorimotor features merge in the term *sensorimotor patterns*. We call them patterns because the targeted movements are possible only thanks to the organised interplay of muscular and joint apparatus. The CNS regulates this organisation and so enables coordinated movement. Damage to the CNS mostly influences the innate motor programs. This handicap may appear because of incorrect intrauterine development or injury to the brain during the delivery or after birth, e.g. hypoxia or cerebral haemorrhage. Impairment of the peripheral nerves (e.g. brachial plexus pals), or trauma to the muscles or skeleton may lead to further disorders of the motor regulation.

The access to the innate motor programs is restricted or denied to children with central coordination disorder of motion. Therefore, they can use their motor skills only insufficiently within the substitute emergency "DOS" program. Consequently, pathological movement patterns occur and their implementation usually causes further secondary damages to the musculoskeletal apparatus. This influence is significantly severe in the first year of life. It strongly limits the very initiation of the physical and mental development, which stagnates without the corresponding motor skills.

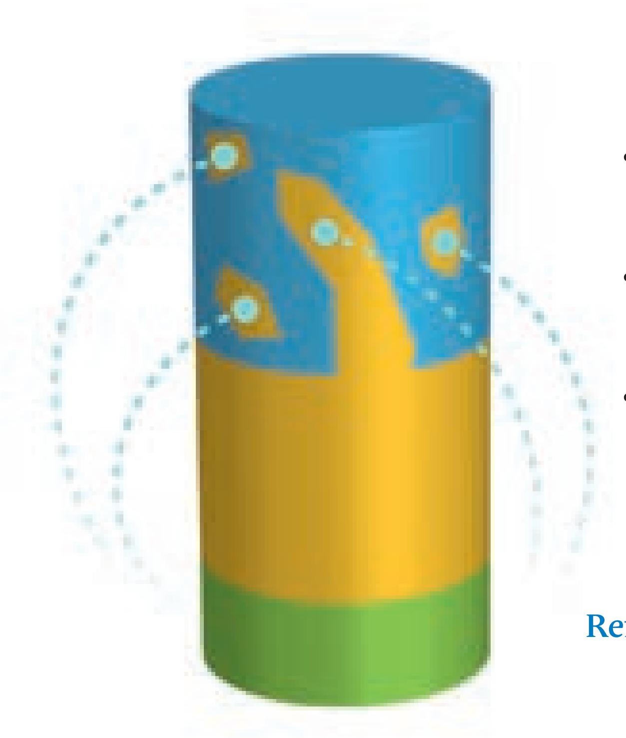
Together with reflex locomotion, Vojta discovered a therapy that can overcome these obstacles. The intact or partially intact connections between nerves and muscles constitute the important precondition because the peripheral nervous system can communicate this way after stimulation.

Physicians, physiotherapists, sports coaches and others approach the musculoskeletal apparatus with certain preformed visions of a 2D anatomical concept. The real physical action of the musculoskeletal apparatus and its physiological correlates are rather different.

What was new in the approach initiated by clinical observations of Dr. V. Vojta is the more promising and open possibilities than the definition of the clinical status of the patient.

Vojta's approach doesn't concentrate on the "processing" of the imperfect body, but on the discovering of the potentials provided by brain and his adnexa.

Neurophysiological view of the program for “movement repair”



- Course of the therapeutic intervention by reflex stimulation with Vojta method or VM2G
- Gradual “healing” of the basic operating program
- Reduction and disconnection of substitute operating program

Reflex stimulation

Figure of therapeutic intervention in the first year of life.

It seems that the trust in the correctness of Vojta’s theory is based on its long-term therapeutic fertility and the ability to predict the upcoming course of the disorders. Equally, it is prized for the ability to predict and explain new unexpected features related not only to musculoskeletal apparatus.

In 1955, Dr. Vojta discovered the possibility of launching the “repair” program through the system of reflex locomotion. This program contains reflex turning, reflex belly-crawling and the less well-known reflex crawling on all fours.

Reflex locomotion implements ideal motor patterns that are strictly individual. It sets the level of muscle, joint and neural burdens exactly in accordance with the actual physical condition, innate dispositions and biomechanical relations of the individual and it practically eliminates the possibility of overload of the musculoskeletal apparatus.

Characteristics of the system of reflex locomotion are remarkable: the program can’t be switched off by any disease or traumatic condition, even at the level of states of deep unconsciousness. In terms of neuroanatomy, the “core” of the program is probably located above the region of the brainstem, i.e. right above the region of regulation of the basic vital functions of the “BIOS program”.

The program works with permanent multifunctional feedback and thereby enables the utilisation of all available reserves of the musculoskeletal apparatus. It is genetically determined and it can be used in every person from birth to the end of his/her life. Probably, it can influence all “application” motor programs of fine and gross motor skills in a significantly positive way.

The fundamental premise of reflex locomotion is this: the organ is developed by its function.

13.1 Bio-cybernetic Model of Action of the Vojta Method

Vojta's principle works with movement patterns, through which the body acts like a single unit. They are called *global patterns*. These movement patterns comprise the whole body, but they consist of many components and partial patterns. Arms and legs have to be coordinated with the torso. Only if all parts of the body act together, can a person stand upright and move.

If one part of the body changed (anatomically or functionally), the relationship with other parts of the musculoskeletal apparatus would change, too. Changed coordinated reaction of other parts appears.

It is necessary to realise this fact because the balance within the body must be precisely regulated during every tiny movement. It resembles a set of scales. If one weight-bowl was loaded, the other weight-bowl has to be equally loaded to reach the balance between both weight-bowls.

The human body shows similar dependency, but in a much more complex manner. This is called the coordination of the musculoskeletal apparatus. In a balanced state, the individual parts of the body are arranged and situated in a balanced manner, and the centre of gravity is situated above the supporting points. That is why every small change within the body that is related to weight bearing activates the whole sensorimotor system of the body to maintain the balance.

Permanent regulation of posture when upright and moving requires permanent cooperation of all muscles. An individual muscle is guided by an established movement pattern, which is regulated according to the common goal that the body wants to reach.

The movement patterns can be analysed and described. For example, the hand grip is a part of a common pattern. It is a part of the movement of the arm and depends on the posture of the whole body because the quality of the posture is basically dependent on the posture of the torso and the spine. Diagnostic and therapeutic interventions find their overwhelming justification only when the movements relate to the posture of the torso and the autonomic regulation of the posture of the body respectively.

The course of the movement of the crawling child that tries to reach the table might be roughly described within the above-mentioned relations as follows: the child has the idea of reaching the table. To accomplish its goal, it mobilises the general motor skills. It has to separate one hand and arm from the crawling movement pattern to reach the table above. It has to hold the body in an upright posture to shift the centre of gravity of the body from four limbs to only three. The spine slightly tilts to the side; it stretches and turns to release the needed space for the arm. If the extension of the arm towards the object wasn't sufficient, the child would pull itself towards the table and lean back on its feet. The child would also use the hand that was formerly meant to extend to pull itself upwards and lean on the feet. Only when its body is surely standing on both feet and supported by the arm, the child extends the arm again towards the object on the table. If the child was close enough to its goal, it would grasp the object. The course of movement described in this example becomes a meaningful and targeted global pattern, within which the arms, the legs and the spine cooperate together in agreement.

13.1.1 The Basic Experience for Further Development

The approach to the whole body helps the child to gain basic experience. Only when it

acts by itself and copes with its own body this way, its experience and perception may widen. The child has to grasp to understand. It has to hear to comprehend. It has to test the objects with its mouth and tongue to find verbal expressions. When a child in the 8th to 9th month of age throws away a toy repeatedly to pick it up again, the behaviour is important because the child is exploring the depth of space. This experience is only possible due to the possibility to use different movement patterns. Initially, the child has no idea how to treat its surroundings. It must touch it and inspect it. It does not know how its little feet taste and how painful it is to hit itself.

Initially, the gait is unknown, just like hopping or crawling. The ability to do such things is partially innate. The development of the motor skills proves that the child is curious and wants to explore and change its environment. This is the only way for the motor intelligence to become varied within all its achievable diversity. This is how their intellectual potential shows up. Mentally retarded children are usually also retarded and less creative in their motor development.

13.1.2 The Interdependence of Autonomic Posture and Targeted Movement

The autonomic regulation of the posture of the body is a basic element for the child and for the adult as well. Thanks to it, we can move in the gravitational field of the Earth. The posture provides support during locomotion. Without the posture, no targeted movement can happen, even a tiny one. This requires permanent adjustment of the autonomic regulation so that the body could permanently maintain the balance and muscle coordination. For example, when a man extends his arm to reach the cup and to bring it to his mouth, the autonomic regulation of the posture of the body is responsible for the continuous movement of the arm away from the torso

and for the targeted lead of the cup to the mouth. The moving musculature of the arm must engage both the supporting parts and the moving parts. Only then will it be able to perform the smooth continuous movement, which carries the cup. If the moving parts of the musculature were not tuned adequately, the movement would be erroneous, uncontrolled and shaky.

Famous neurologist R. Magnus [19] put it aptly when he said: *"Every movement begins and ends with a posture. Posture follows the movement like a shadow."* In case of a limb that wants to get the cup, it begins with the posture of the torso and the support of the lower limbs that have to hold the resistance targeted against the gravity and make the way of the arm away from the body possible. Further, the musculature of the arm carries the arm against the gravity and moves towards the cup concurrently. This movement of the arm is secured while sitting, e.g., by the pelvis legs and feet.

13.1.3
Security within the Posture

If we watched an infant during its first 6 months of life, we would see that the security within the posture outweighs the movement. The infant remains in the supine and also prone position. If the child grasped a toy e.g. in the 5th month of age and put it in its mouth, the movement of the arms and legs would seem to be suppressed depending on the regulation of the posture. But the arms and legs cannot be intentionally raised above the pad without the posture of the torso that is safely supported in the back.

Later, in the higher upright positions, the principle seems to be even more obvious to the observer. When crawling or walking, we first see the movement of the arms and legs, that carry the body forward. We might think that the posture has lost its importance. The opposite is true. The body requires the dynamically adjusted posture of the torso and the limbs to move this way. The higher the body straightens, the less it uses the surfaces of support. Consequently, the maintenance of balance becomes more difficult. The posture has to be regulated even more finely compared to lower supine or prone positions so that it would not stagger or fall and can move intentionally.

To overcome gravity is the basic and permanent task. The centre of gravity is being

19 ORTH, Heidi. Das Kind in der Vojta-Therapie München: Elsevier

transferred with every move and balance has to be reset. The movement requires permanent autonomic regulation of the posture as the firm support allows the movement towards or from a target. Thus the regulation of the body is required to develop adequate posture and enable movement. It could be seen in helpless new-borns, whose posture is not adequately regulated and cannot provide the support. The gravitational force pulls them to the pad and they cannot use it as surface of support. During the next development, e. g., the back takes over the function of the surface of support.

If the infant learnt to turn, the shoulder and hip joints and also the whole side of the body, over which the child rotates, would become the surface of support in the position on the side. If the child developed unaided gait, the centre of gravity would be set against the small surfaces of support on the soles.

Sports, that are admired because of the performances of jumps and pirouettes, e.g. figure skating and gymnastics, are also extremely challenging for coordination. They are possible to do because of exceptionally powerful regulation of the posture of the body. Implementation of this precondition allows the performance of excellent physical creations, but often it is not perceived nor observed.

To accomplish the jump on ice successfully, it requires support on a minimal surface, which is not ideal for support nut which allows minimal friction and minimal adhesion. Moreover, the sole of the skater does not lean on the ice directly, as he stands on the sharp skate blade. That requires the flawless and finest utilisation of the coordinated posture of the musculature to provide balance in such a labile occasion because only then could the jump be accomplished. An uninformed observer can hardly see the background of regulation of the posture of the body and the necessary muscular functions.

On the other hand, movements of an individual who deviates from the common ideal of normal motion and whose ability of autonomic regulation of the body's posture does not work properly is quite noticeable to the observer. This is obvious in certain

forms of cerebral kinetic disorders such as spastic gait or dystonic locomotion. Spasticity is manifested in a cramped and stiff posture that wouldn't make continuous movements possible. Dystonia is the opposite; it lacks the posture that secures and leads the motion. That is how the shooting, exaggerating and restless movements appear.

The lack of control over the autonomic regulation of the posture results in significantly abnormal locomotion in both above-mentioned motor disorders. Thus, the quality of motion is based on the corresponding ability of autonomic regulation of posture. The analysis of posture can exactly predict the conclusions on the future quality of the locomotion itself.

The function of most muscles is not derived from the anatomical description, but from the function, that has been "centrally given" within the autonomic regulation of posture, balancing and righting reflexes and basic stereotypical movements (gait, grip, respiration, etc.), and finally within application programs.

Concurrently, the muscle functions vary depending on the changes of physical positions and performed movements. The same muscle can provide the postural balance of the body (e.g. in supporting or straightening) and in the next moment, its function changes to active movement within the gait mechanism. This functional variability is a necessary precondition for the functionality of the musculoskeletal apparatus as a whole. It's hard to imagine the luxury of having a body that has the muscles intended for gait and balance maintenance separated from each other. The "single-purpose" muscular function is designed only in highly specialised muscles, i.e. the muscles of the vocal apparatus, swallowing muscles or facial muscles.

Those muscular groups are rather small and energetically economic. They occur to greater extent in humans only.

More detailed observations of the musculoskeletal apparatus show that both sides of the body perform the upright standing, supporting and kinetic functions in functional steps that are mutually interconnected. This is caused by both sides of the body complementing each other in targeted movement, upright standing and walking through the central coordination.

Continuous transfer of the centre of gravity is provided by the exchange of the supporting and mobile elements. Permanent regulation of balance is related to this exchange. It can be noted that it's nothing special to perform the above-mentioned movements. The individual with the physiological posture of the body doesn't think about the motion at all. He takes these preconditions of locomotion for granted. Nevertheless, the initiation and the course of movement may represent insurmountable obstacles for the individual with disordered utilisation of kinetic patterns (i.e. suffering from kinetic disorder). Continuous changing of the positions of the body, which is normal in healthy individuals, requires permanent adjustment of the autonomic regulation of the posture. That is implemented by the flawless function of the CNS that regulates functional programs.

13.2
Case Study – Utilisation of VM2G in Therapy of Severe Central Palsies

13.2.1
Illustration of Solution of Central Palsy – Cerebral Palsy, Dyskinetic Type

The mother brought the patient Kateřina to our office when she was almost three years old. Kateřina could not walk on her own or maintain balance while standing or walking. The disability had been diagnosed too late, so the therapy was also initiated too late. The

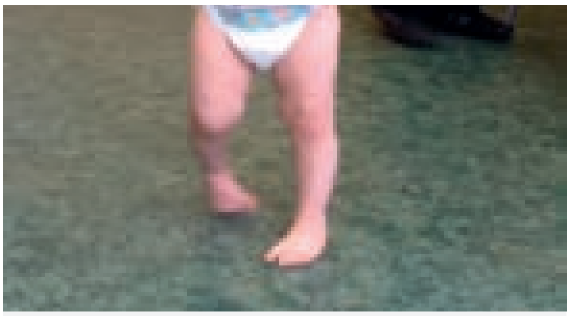
Video

Pathological response during exercise
bit.ly/2nWJjt0

Video

Miřejovská Pavla
3 years 4 months
bit.ly/2oslCGy

Miřejovská Pavla
3 years 4 months
bit.ly/2osyxIW



Video of pathological stereotypes and postures
bit.ly/2nKyn1b

neurological conclusion said it was a cerebellar form of cerebral palsy (CP) of the dyskinetic type.

Besides walking, the patient needed help with ordinary self-care. Her movements were very uncoordinated. Previous rehabilitative efforts were focused on conscious training of coordination skills.

13.2.2 Description of the Problem (Clinical Findings)

A thorough history revealed that shortly after birth, the patient underwent massive cerebellar bleeding. Ultrasonography showed damage to the medial region of the cerebellum. With remarkable difficulties, the patient could maintain unaided standing; she could only walk with support. Therefore, her mother supported her by one hand when walking. Gross motor movement, the autonomic regulation of the standing and the basic stereotypical movements of gait and grip were impaired. Dressing, undressing and food intake could be managed only with the relevant help of the mother. Motor skills of fine and gross movements were impaired by dyskinesia. The movements ware asymmetrical and poorly coordinated. Perception, curiosity of the surroundings and the endeavour to communicate indicated that mental functions had not been disturbed. The mother understood well that future development of her daughter without rehabilitation would lead to deepening of the disorder, increasing in the ataxia, disability and overall dependency on the help of others.

13.2.3
Expert Explanation of the Problem

The incidence of cerebellar form of cerebral palsy is not too common. It affects prematurely born children, but it can also be caused by infection during pregnancy. Cerebellar cerebral palsy is characterised by ataxia. These are uncoordinated movements that appear because of considerable impairment to the targeted motor skills. Because of severe impairment of the fine motor skills, a patient with a severe cerebellar form of cerebral palsy is dependent on the help of another person. The patient can't utilise the basic self-care tasks at all (or with great difficulties.)

This patient suffered from a pure form of cerebellar CP, so she didn't have spastic shortenings of the muscles. These changes of regulation of muscle tone significantly worsen the regulation of motor skills, particularly if it was disturbed by dyskinesia. The effort of intensive and early rehabilitation is to prevent the development of these severe impairments of motor functions. In terms of early diagnosis, impairment of cerebellar motor functions could be observed quite early after birth. Hints of dyskinetic movements appear in both spontaneous and elicited motor expression. Symptoms of this dyskinetic pathological locomotion are quite discrete within the first six months of life, but they can be seen mostly on acral parts of the arms as torsion movements. Omission of warning signs quickly leads to the onset of ataxic motor skills after the accomplishment of the first developmental year of life. The disorder is manifested in impaired regulation of coordinated locomotion and in impaired central autonomic regulation of muscle tone in terms of general hypotonia. This type of hypotonia makes the maintenance of posture of the body difficult and disturbs the stereotypical gait.

This disorder gradually deepens and ossifies with the development of the musculoskeletal apparatus. It is projected into the autonomic regulation of the posture of the body, basic stereotypical movements, fine and gross motor skills and the active conscious locomotion in particular. It's the active conscious motion that is practically utterly devastated by dyskinetic and ballistic movements, which are difficult to control consciously.

The possibility of reparation is getting worse significantly as time goes on. Our experience taught us that early diagnosis of the disorder, ideally within the first three months, and early initiation of intensive and targeted rehabilitation can lead to improvement and very good prognosis. In the case of this patient, who came to us with the fully developed cerebellar form, we would like to show that with VM2G, gradual improvement of the condition can be achieved.

13.2.4
Illustration of the Solution

Introduction of the rehabilitative care with VM2G entailed a great divide for the patient and her mother. The previous rehabilitative care took place at the outpatient office. Mother began to accept the role of the home therapist, who bears the great part of responsibility for the future of her daughter. The home exercises were performed daily and took thirty to forty minutes. Initially, the exercises had to be performed on the mat on the floor, even during the regular biweekly check-ups at our office. The patient started to tolerate the exercises on a medical lounge much later.

The initial success was that, after several months of hard work, dyskinesia and ballistic movements ceased to worsen. Gradually, the patient reached the phase of unassisted walking. The handiness and coordination at dressing and undressing improved, and the patient began to manage the unaided food intake.

The patient had to wear tailored shoes that improved the stability of her ankles. The next success was putting aside the orthopaedic shoes and the possibility to wear the shoes bought according to her own choice. Of course, this was more comfortable and significantly less expensive than tailoring of the high orthopaedic boots. The speech expression gradually improved. The reduction in dyskinesia and ballistic movements was manifested in improvements of soft motor skills of the hand as the patient started to draw and write. She was gradually being prepared to enter elementary school – she has begun to attend the fourth grade this year. Practically, she needs no assistance in common daily activities. The therapy started to become physically demanding for the mother, who was keen to accept the offer of training together with the home therapist. They have attended the check-up visits in the office and performed the home therapeutic exercises together. The involvement of another home therapist has made the training much more effective and the results obvious. In general, the patient is more stable at standing and walking, even on rough terrain. Both mother and patient evaluate this development as very optimistic and are prepared to continue with the long-term therapy.

13.2.5 Explanation of the Solution

The performance of the intensive physiotherapy in children with developed CP syndrome is always a difficult task. In case of the cerebellar form of CP, the therapy of the developed syndrome is extremely complicated and is among the most complex ones in terms of physiotherapy.

The very implementation of the therapy has to return to early developmental stable supine position. As the patient perceived significant positional lability and suffered from severe positional instability due to dyskinesia, it was necessary to perform the reflex stimulation in the low position on the mat on the floor. After more than a year, we could afford to go to exercises on the launcher, as the lability and perceived instability in elevated positions ceased. The initial goals of the therapy must be concentrated on re-establishing the cornerstones of the motor skills. Any effort to stand upright and activate the walking mechanism prematurely couldn't be successful because the resulting motor expression would be permanently disturbed by muscular dystonia and ataxia. Only gradual repair of the basic program of motor skills responsible for the basics of standing upright would enable the transition to higher positions and to a more developmentally matured movement.

Achieving the progress in normalisation of the autonomic regulation of the posture of the body allows the therapy to focus on development of basic stereotypical movements. All this is possible because of the gradual building of programs of motor skills in a reflex unconscious fashion. Functional autonomic regulation of the posture of the body provides the conditions for basic stereotypical movements and, subsequently, the possibility of implementation of fine motor skills and extension application programs of locomotion. All these circumstances have to be kept in mind during the restitution of motor functions in such a severe disorder as cerebral palsy.

13.2.6 The View of the Possibilities of Restitution of Motor Functions in Cerebellar CP and the Solution in Terms of VM2G

VM2G is targeted on the reconstruction of basic programs of the motor skills by the performance of reflex stimulation under uneasy, arousing conditions. The elicitation implemented with tilted training surfaces and lability support significantly helps to reconstitute the programs responsible for autonomic regulation of posture, i.e. the righting, balancing and labyrinthine reflexes.

Tilted surfaces are suitable for early use in exercises on the floor, as the feeling of stability and prevention from falls is secured.

Positional instability and the subsequent anxiety constitute the factors that have to be always considered in treatment of cerebellar palsies, i.e. even if it was possible to go to higher developmental and righting positions. Disrespect of this psychosomatic fact could significantly limit the intensity and implementation of the therapy itself. Although it might seem illogical to use these labilising aids in this type of disorder specifically, experience has shown that the sensitive approach can activate the reflex stimulation by labilisation without provoking disturbing dyskinesia or ballistic movements. Consequently, there is a growth in the programs of autonomic regulation of the posture of the body and basic stereotypical movements. We can't conceal that fact that this is extremely difficult from a therapeutic perspective.

Another factor that must be considered is the phase of accelerated somatic growth. To become aware of this phase, the measurement of body height with sonographic altimeter during each visit in the office proved to be useful. Children within the phase of accelerated growth are in a phase of mild discoordination of the regulation of motor skills. This is visible in a very mild form even in healthy children, as is often noted in folk sayings. The explanation lies in the disproportion between the quickly grown body and the ability of motor programs to provide sufficient "computing performance" to control this abrupt increase in "HW".

In children with cerebellar palsy, this transient increase in discoordination is much more obvious compared to healthy children. The therapy and the amount of exercise have to be adapted to this transient state of deteriorated regulation. Careful measurement would reveal the onset of accelerated growth, so we can directly react with the therapy. Therapeutic corrections have to be implemented almost continuously to utilise the potential offered by VM2G to the maximum.

The essential achievement we have attained was the prevention of development of dyskinesia and the possibility of gradual development of motor skills towards a normal state. It is necessary to expect that the late commencement of therapy of the cerebellar paresis would necessitate great strength and many years of treatment.

The goal is to get as close as possible to the normal locomotion, autonomic regulation of the posture including the basic stereotypical movements, and to normal and developing trophic features. Omission of the diagnostic and therapeutic intervention in children with cerebellar paresis is a source of upcoming severe restriction of the development of the personality of the patient. This restriction is manifested in many aspects of life, i.e. education, sports and cultural activities. It also represents significant social stigma, including the restriction of future economic self-sufficiency.

14. Bio-Cybernetical Model of Action of Vojta Method

14.1 Body Scheme Perception

So far, most agree that the perception of the body scheme is a matter of continuous learning. The idea of one's body should be based on experience and the associated perception with the body. This should lead to saving the sensorimotor information at different levels of the CNS. The possibility to be aware of one's body and its position within the environment is facilitated this way.

To reach the normal and maximal possible sensorimotor development of the child, it is necessary for the arrangement within the CNS to create one single integrated self-image. The question is whether the information that forms this body scheme is created by external and intrinsic stimuli in the form of gradual learning.

I think that it is only gradual "unzipping and saving" of the inborn programs of sensorimotor creation of the body scheme. The program for sensorimotor perception is only a part of the basic operating program for motor skills. It is a part that provides feedback for regulation of the musculoskeletal apparatus. Feedback is a component of every regulation. Thus, the regulation of motor skills also depends on the permanent multifunctional sensorimotor feedback. Its flawless function is necessary for permanent correction of movement deviations. We certainly cannot talk about a learning process that is not a suitable tool for the complex and mostly automated motor skills.

As the other even more primitive regulatory programs contain a regulation feedback component, the extremely complicated programs of the musculoskeletal apparatus possess the biofeedback component as well, i.e. the sensorimotor skills. The evidence of the properly launched and working feedback of sensory function is the ability of correct body scheme perception. We can talk about this truly conscious perception only in children, whose mental level of individualisation and separation has begun to mature. Many years ago, Jean Piaget described this phenomenon within the development of mental functions in children[20]. The creation of the body scheme is significantly delayed in children who haven't undergone physiological development of the musculoskeletal apparatus. Its impairment is in direct proportion to the damage of the regulation of motion. The typical example could be the impairment of stereognosis, i.e. the ability to recognise the shape of objects by touch.

The function of therapeutic models that don't respect the developmental rules of kinesiology must resort to utilising reflex gait automatism.

It can be evoked early after birth and, as a primitive reflex, it fades away early. Its extinction is necessary in order to "make space" for developmentally higher levels of regulation. Gait automatism can be launched

20 PIAGET, Jean. Psychologie dítěte, Praha: Portál, 2010. ISBN 978-80-7367-798-5

under specific conditions. The child is being held in a vertical axis against gravity, and the support of one limb initiates walking. Holding the child excludes the necessary regulation of antigravity supporting mechanisms and autonomic regulation of the body.

Gait training in patients with motor disorders imitates the similar situation (mostly walking in Lokomats or other hanging devices). Passive hanging of the patient excludes the necessity of regulation of antigravity supporting mechanisms. Hence, patients don't have to control their autonomic regulation of the posture in the space. Their gait is dominantly regulated at the spinal level, similarly to newborns and their gait automatism.

If the basic "cornerstones" of regulation of motor skills were missing (antigravity and supporting mechanisms and the autonomic regulation of the posture of the body), it would be practically impossible to "train" the bipedal gait.

"Bipedal gait is the universal basic pattern of human locomotion." (Vojta, 2009)[21] Its "cornerstones" are supporting and antigravity mechanisms, autonomic regulation of the posture of the body in the gravitational field and the stereotypical gait.

These three pieces are mutually interconnected. They have been created during the development of the first year within the developmental ontogenesis. They have been described in detail by developmental kinesiology. Therapeutic thinking must be based on them during the treatment of disorders of bipedal locomotion in children and adult patients. The therapy must be focused on restitution of all three of the above-mentioned cornerstones.

21 VOJTA, Václav. Vojtův princip, Praha: Grada, 1995. ISBN 80_7169-004-X

14.2 Stimulation of Reflex Zones and Reflex Points within VM2G

Stimulation of reflex zones and reflex points, the way it was introduced by Vojta, still hasn't changed within the classical implementation of the Vojta method. Activation of these reflex points is performed by applying pressure with the fingers, thumb or the outer edge of the hand. Stimulation by pulling these zones is also performed with fingers, thumb or the whole hand. This kind of stimulation is not comfortable for the patient, infants in particular. As the longer effect of pressure or pulling leads to slow retreat of the soft tissues at the point of contact, the pressure/pulling starts to irritate the periosteum with increasing intensity. Innervation of the periosteum is not physiologically adapted to increasing stimulation by pressure or pulling on a small surface. This increasing mechanical irritation induces a defensive reaction – pain that is supposed to protect the organism from possible damage. On the other hand, long-term mechanical stimulation that is adequate in terms of force and area of stimulation is tolerated very well and ultimately leads to the activation of osteoblasts and increase in bone tissue.

If the soft tissues, mostly muscles, were subjected to pressure stimulation with fingers, their reaction would be also perceived as uncomfortable or painful in a short time. Physiological stimulation of the muscle by mechanical pressure on small area causes gradual ischemia of affected muscle fibres. But when the stimulation is performed on a larger surface over a sufficiently elastic separator that has the ability to "dull" the margins of the stimulation, the muscle adapts quite easily because no ischemia and subsequent pain occur.

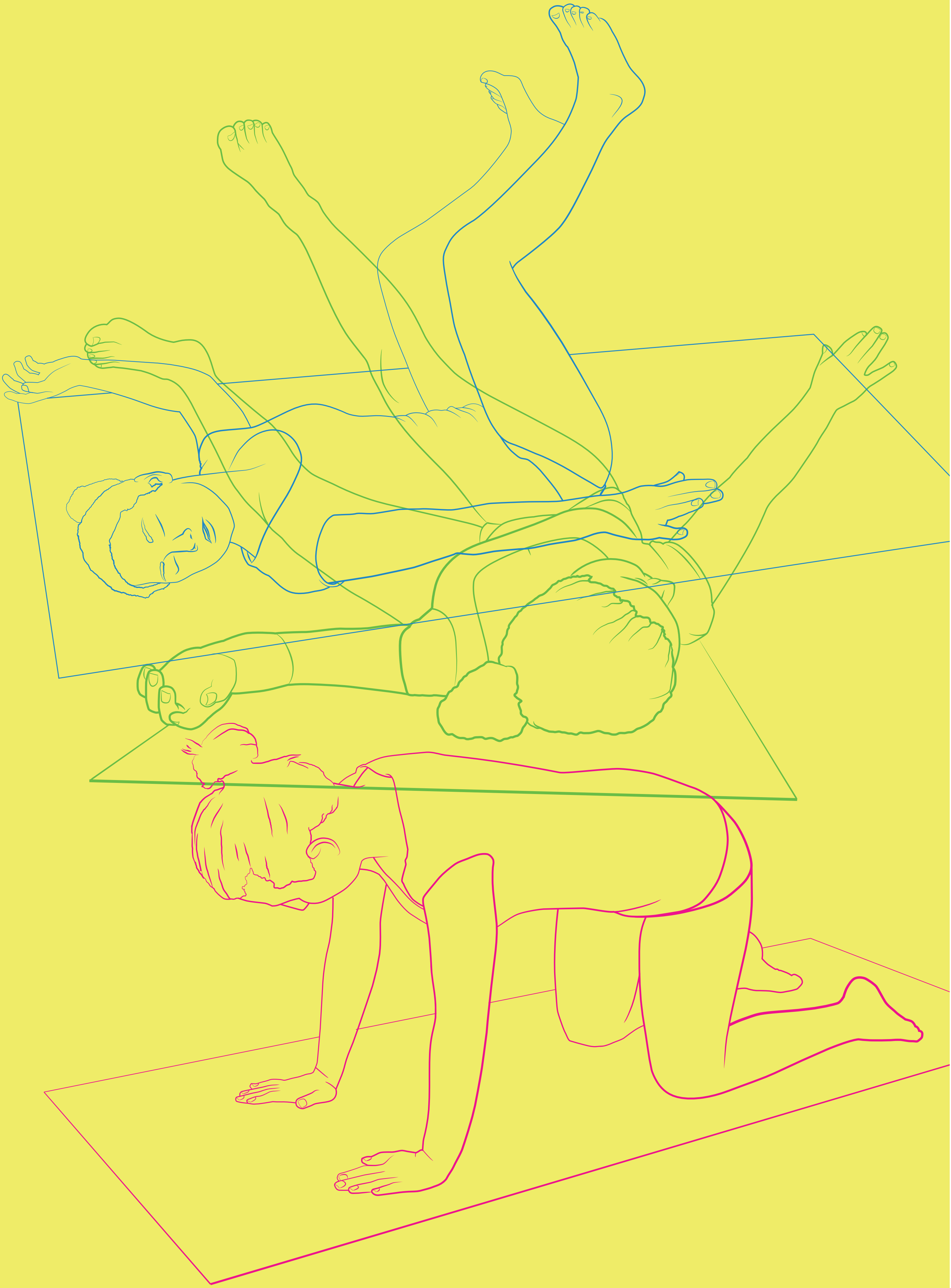
The implementation of classical stimulation with fingers reduces the time, in which it is possible to perform the therapeutic stimulation. It is possible within the order of tens of seconds up to one or two minutes most.

Hands of the therapists and parent, who exercise with their children at home, represent a considerable limiting factor of classical performance of the Vojta method. Long-term isometric pressure or pulling with fingers is inadequate in terms of biomechanical construction of the fingers and the hand. It often leads to overload and subsequent discomfort, mostly inflammations of tendons of the hand and the forearm.

The use of elastic separators within VM2G has proved to be suitable for the following reasons: it removes the pain from stimulation by pressure or pulling; it enables longer implementation of the stimulation; it limits the overload of the hands of the therapists and the parents; it allows gradual temporal and spatial intensification of the stimulation, and it allows maintaining the correct vectors of stimulation pressures and pulling easily.

The existing method of retaining the exact direction of the stimulation by means of the classical Vojta method wouldn't be probably necessary. The problem was well presented by the results of the thesis "Stimulation of zones used in reflex locomotion with TENS" by Markéta Vodňanská.[22] The goal of the thesis was to demonstrate whether the stimulation of the trigger zones with transcutaneous electric neurostimulation during Vojta's reflex locomotion in the form of reflex belly-crawling would lead to activation of the respective locomotion pattern as with manual stimulation of the trigger zones of reflex belly-crawling. The results demonstrated that the locomotion pattern of reflex crawling induced by manual stimulation of trigger zones can also be induced with TENS by stimulation of the same trigger zones. It implies that the vector of the direction of the stimulation and the pressure during manual stimulation of the zones is not necessary for induction of the locomotion pattern of the reflex crawling. Further, it was found that during stimulation of the torso zone either manually or with TENS, the same order of activation of selected muscles appears in each person. The order of activation during the stimulation of the heel zone is completely individual.

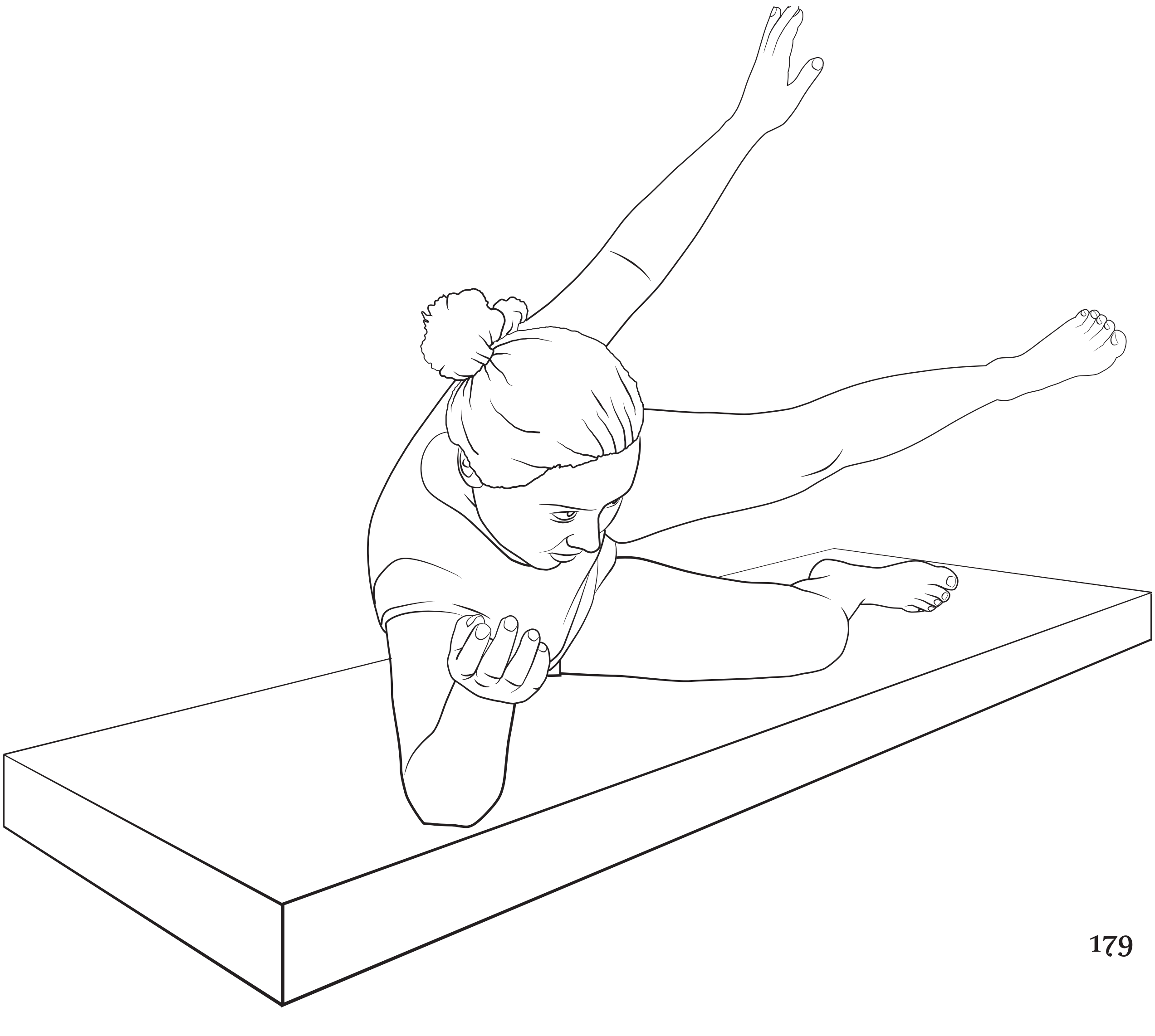
22 VODŇANSKÁ, Markéta. Stimulace zón používaných při reflexní lokomoci pomocí proudu TENS. Praha, 2011. Thesis. Charles University, FTVS. Head of the thesis: PhDr. Jitka Čemusová, Ph.D. Also available at : https://is.cuni.cz/webapps/zzp/detail/108129/



15. New therapeutic options of VM2G

Therapeutic approach of VM2G to implementation of reflex stimulation has achieved a significant progress. Thanks to the technical instruments used within VM2G therapy, the "technology of reflex stimulation" has acquired new attributes and revealed several new characteristics of the Vojta method. The newly discovered therapeutic possibilities of VM2G have been proven to be extremely efficient in children and adult patients.

The fundamental progress has been manifested in induction of the therapeutic reflex locomotion itself. Within VM2G, the reflex runs in an on-off mode. VM2G launches only the program of physiological locomotion without risk of induction of the substitute pathological program. Thanks to these features, VM2G is safe. Under supervision, it could be safely delegated to parents, other family members, close friends or "home therapists".



VM2G induces the therapeutic reflex without risk of causing painful impulses in practically all patients. It is excellently tolerated in the long term. VM2G allows regulation of the therapeutic intensity of the stimulation and thus a significant increase in the efficacy of the therapy. The possibility of regulation consists in the overall increase or decrease in stimulation and in targeted focusing of the therapy. The therapeutic effect itself is long-lasting, even in patients who started the therapy in a chronic stage of difficulties.

Correctly implemented VM2G prevents the recurrences and allows the patients to return to long-term physical exercise.

VM2G therapy could be initiated immediately after cessation of the acute state, including the postoperative conditions.

Vm2G therapy significantly increases the comfort of the patients and the therapists as well.

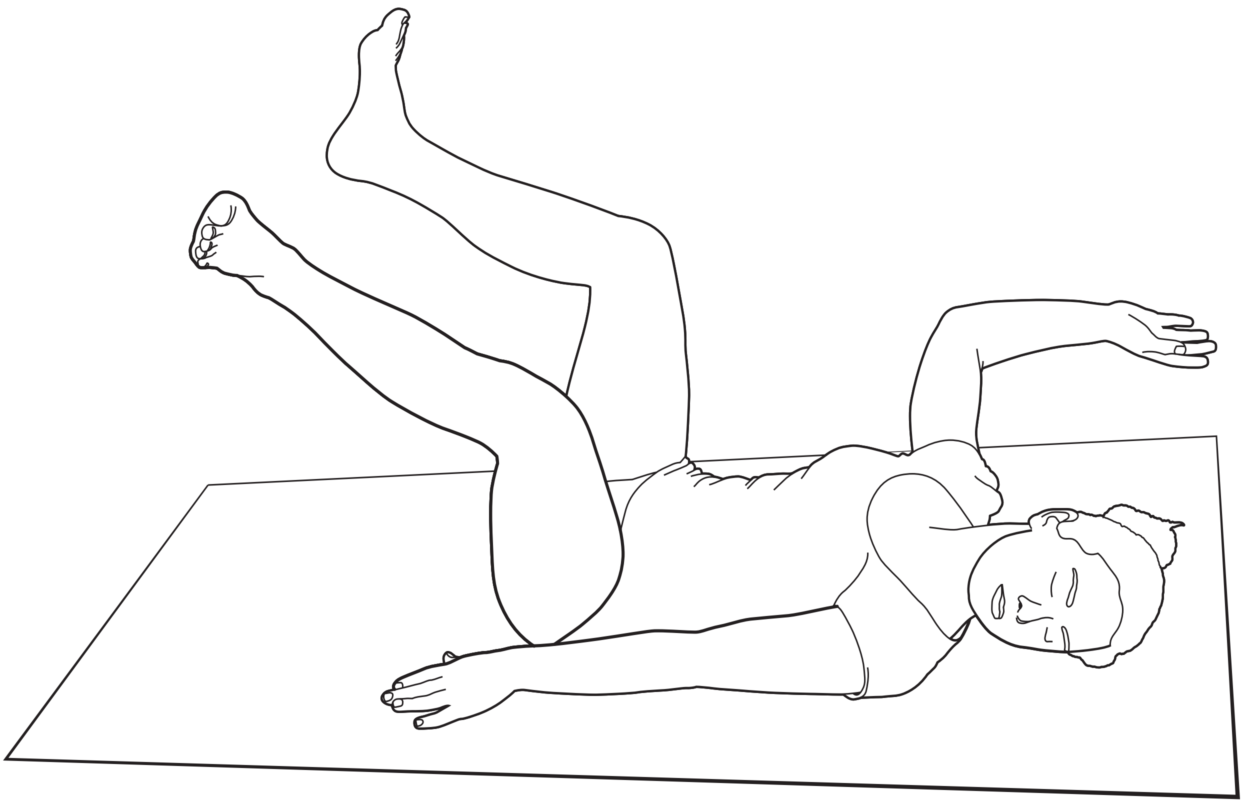
15.1 New Therapeutic Utilisation of VM2G

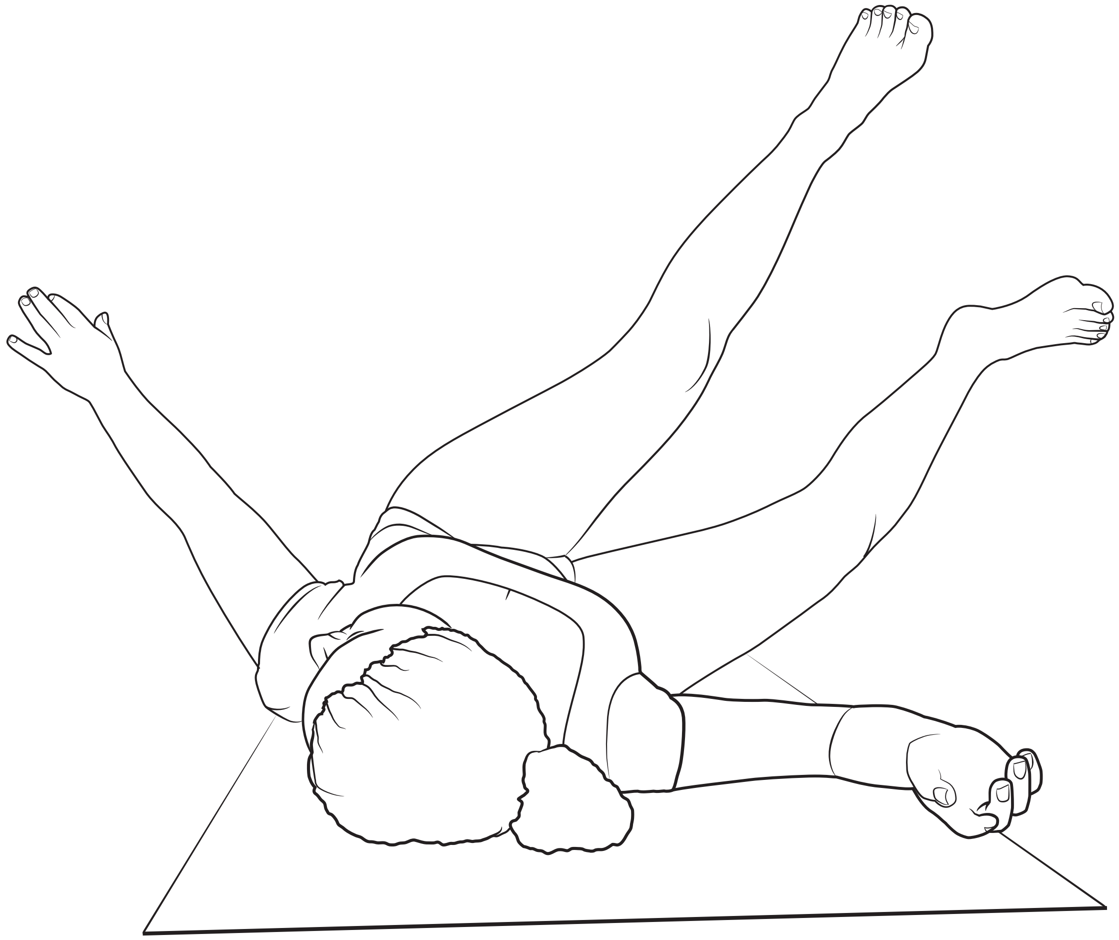
The practice of the therapy is possible in infant patients with central coordination disorder, who are at risk of impairment of motor development, in a way that allows the regulation of the therapeutic intensity without risk of pathological development emerging.

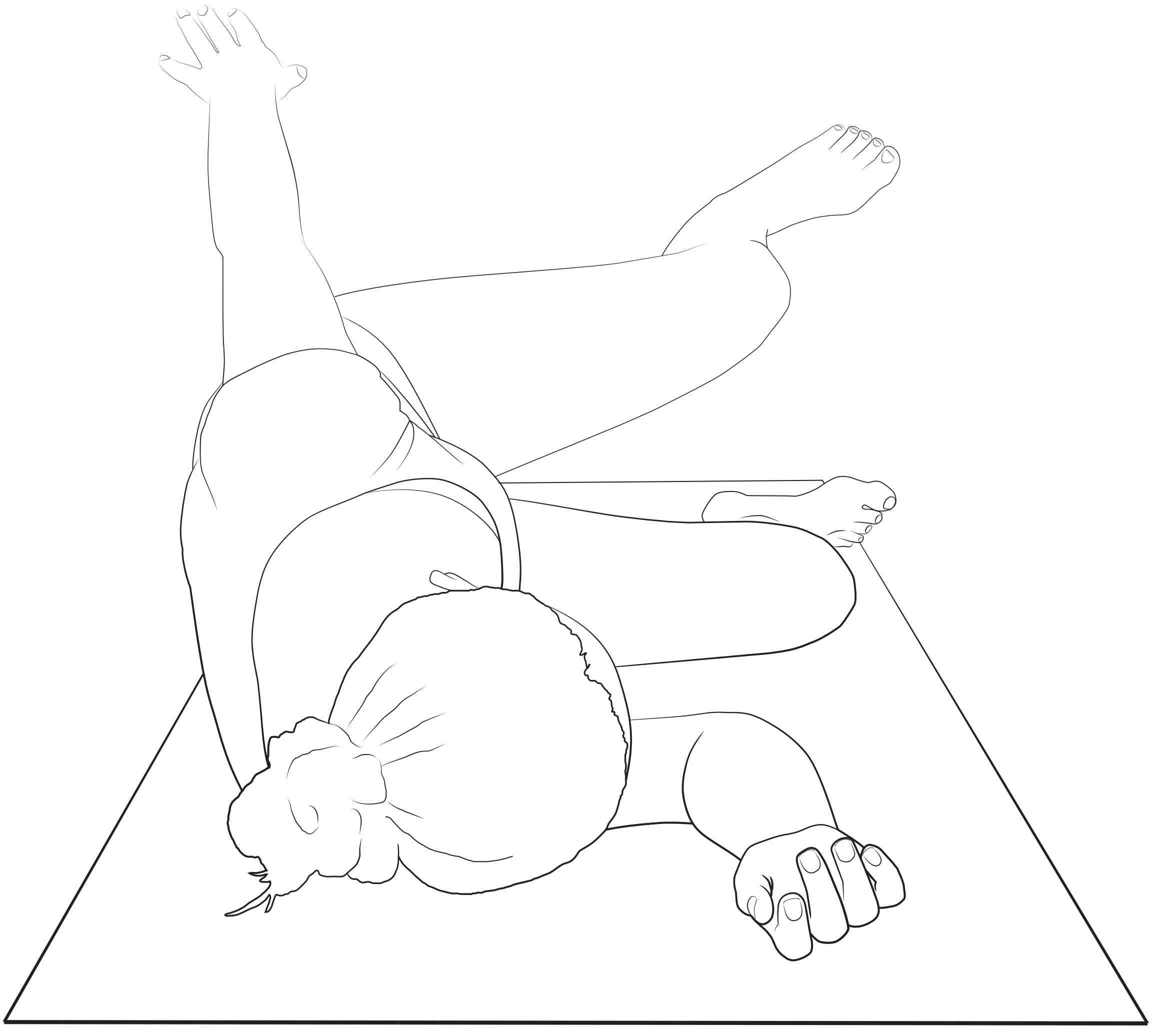
It's possible to safely conduct the therapy in preschool children.

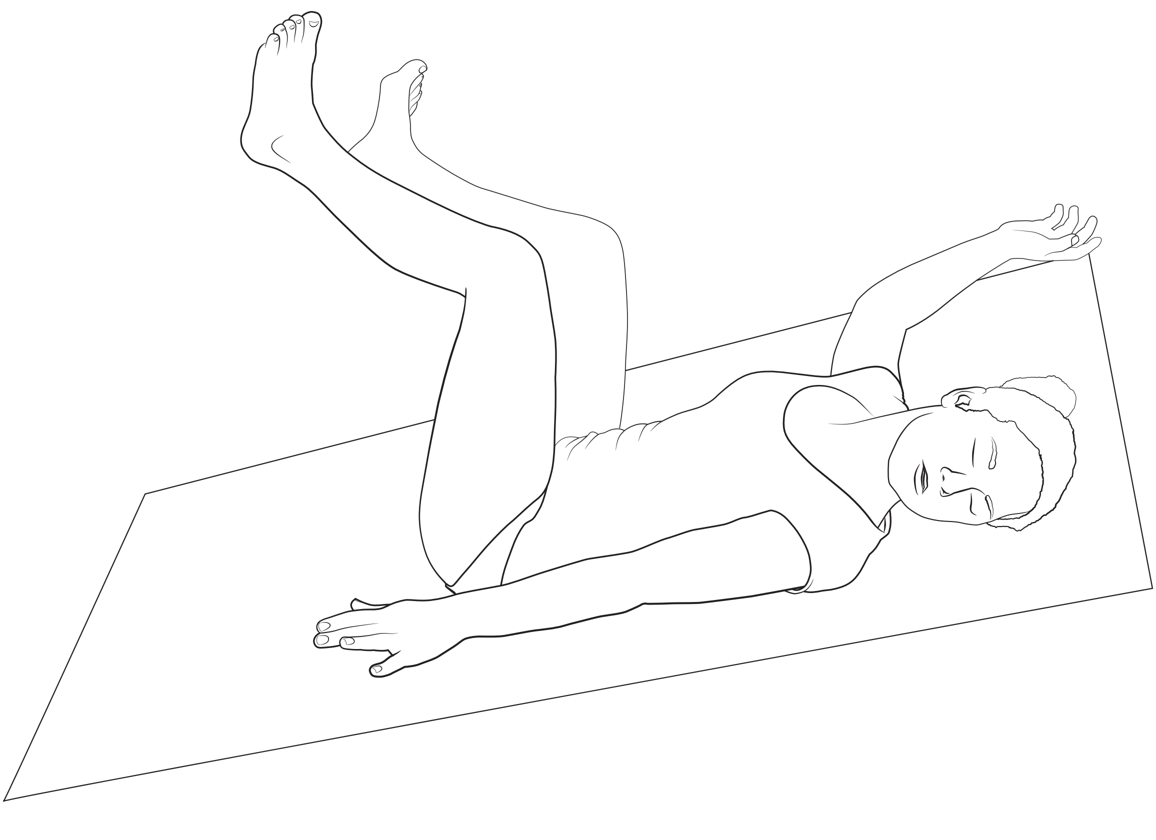
VM2G can be conducted in children with attention disorders, hyperactivity or mild cerebral dysfunctions. Experience shows that the therapy could be performed even in children suffering from disorder of an autistic type. Long-lasting therapeutic practice indicates that there's been beneficial utilisation of VM2G in patients with gynaecological problems, in pregnant patients and in patients with urogynaecological problems.

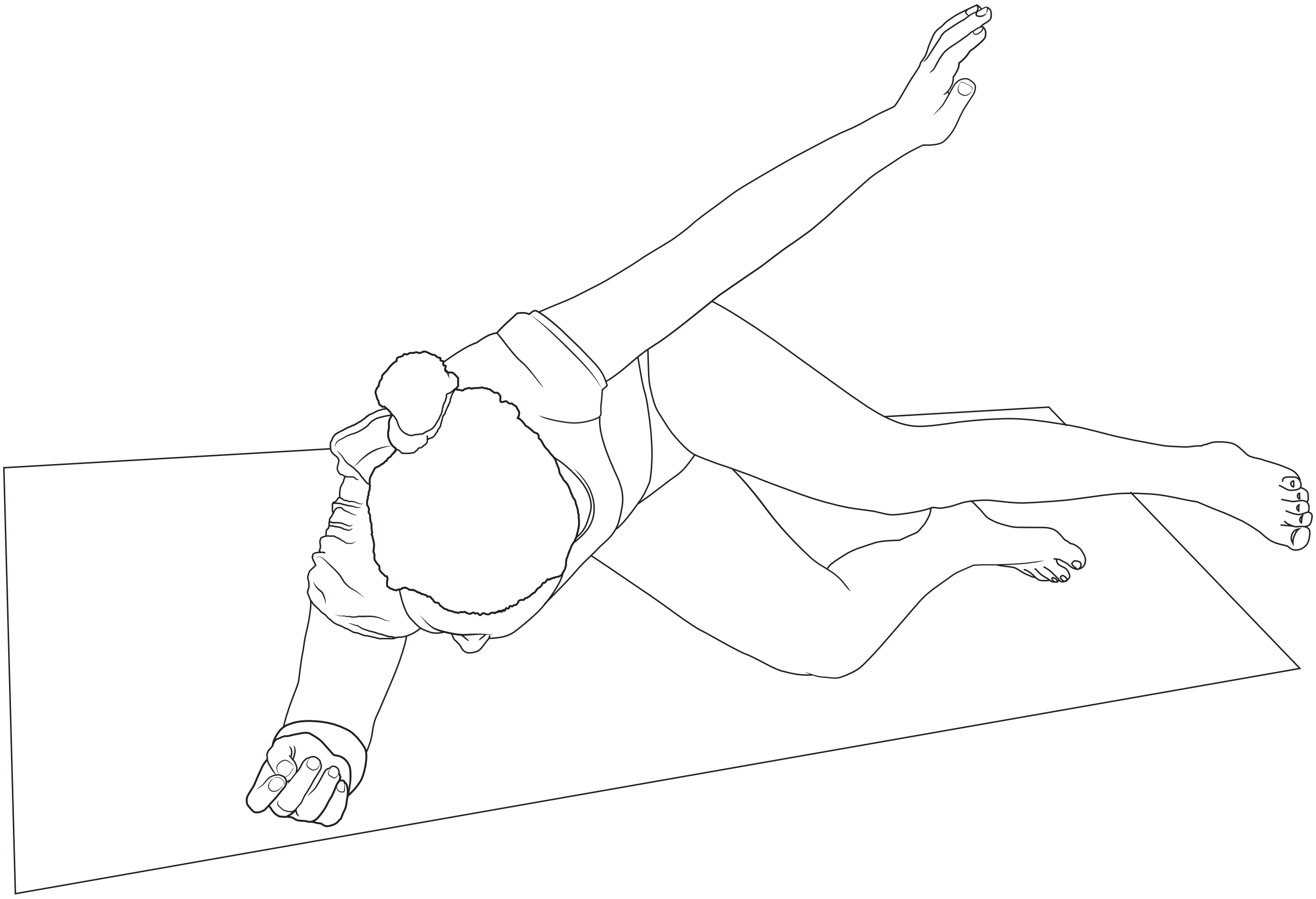
VM2G has delivered good results and excellent therapeutic tolerance in psychiatric patients after cessation of acute problems.

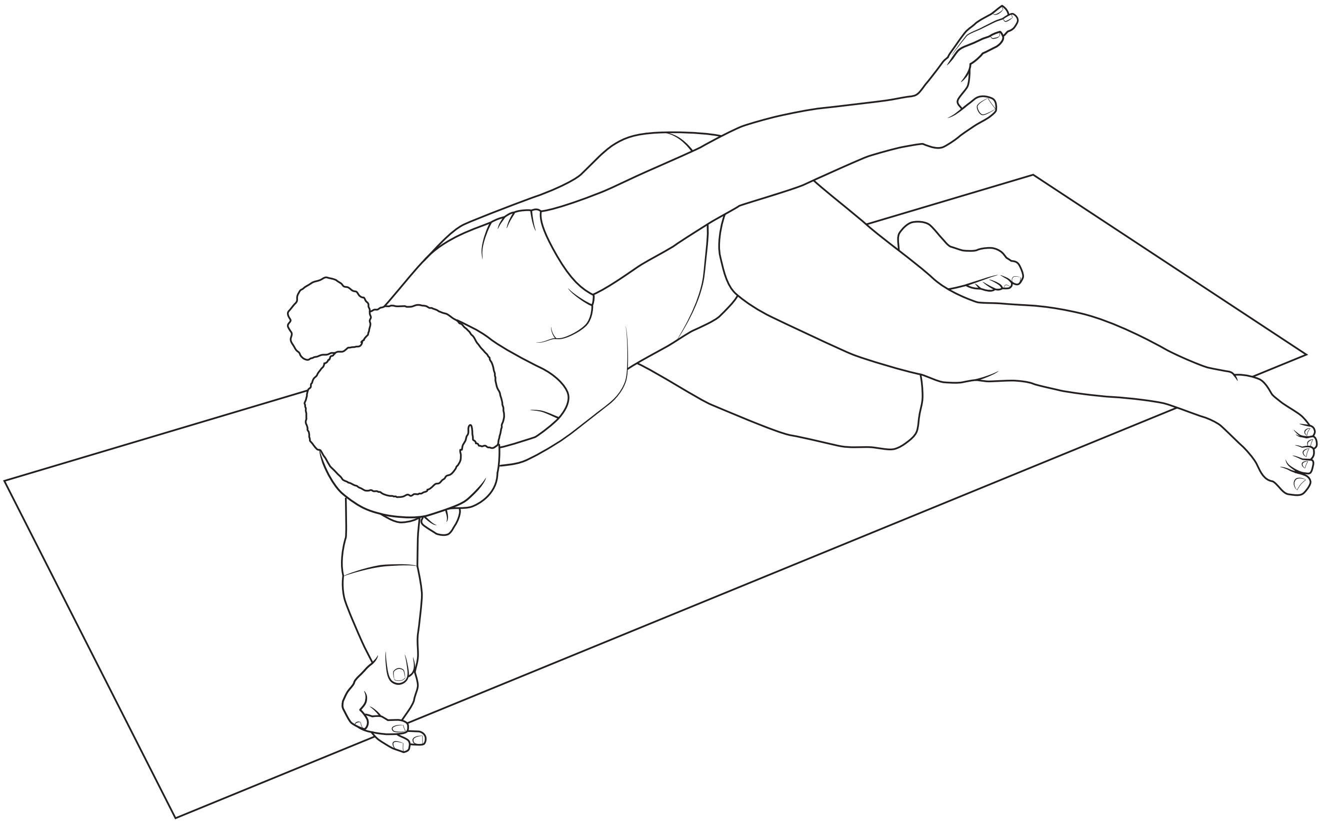


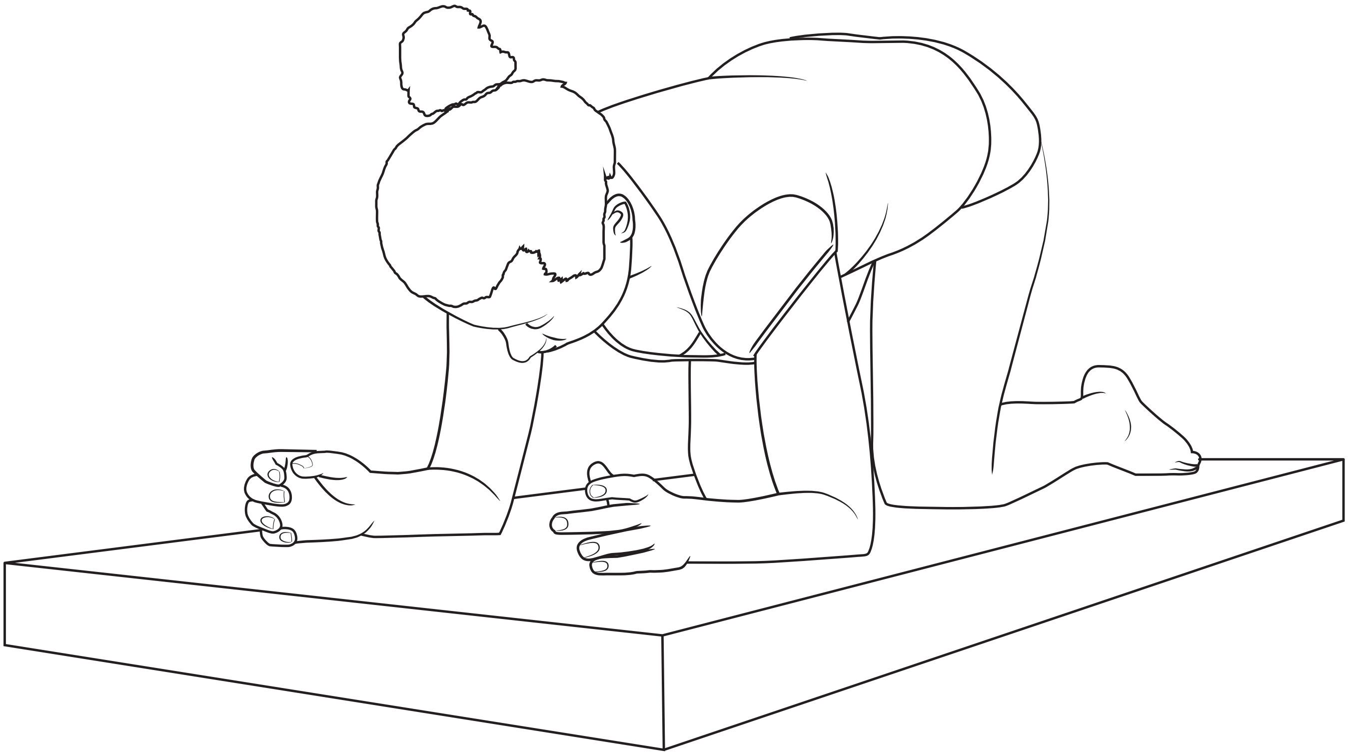


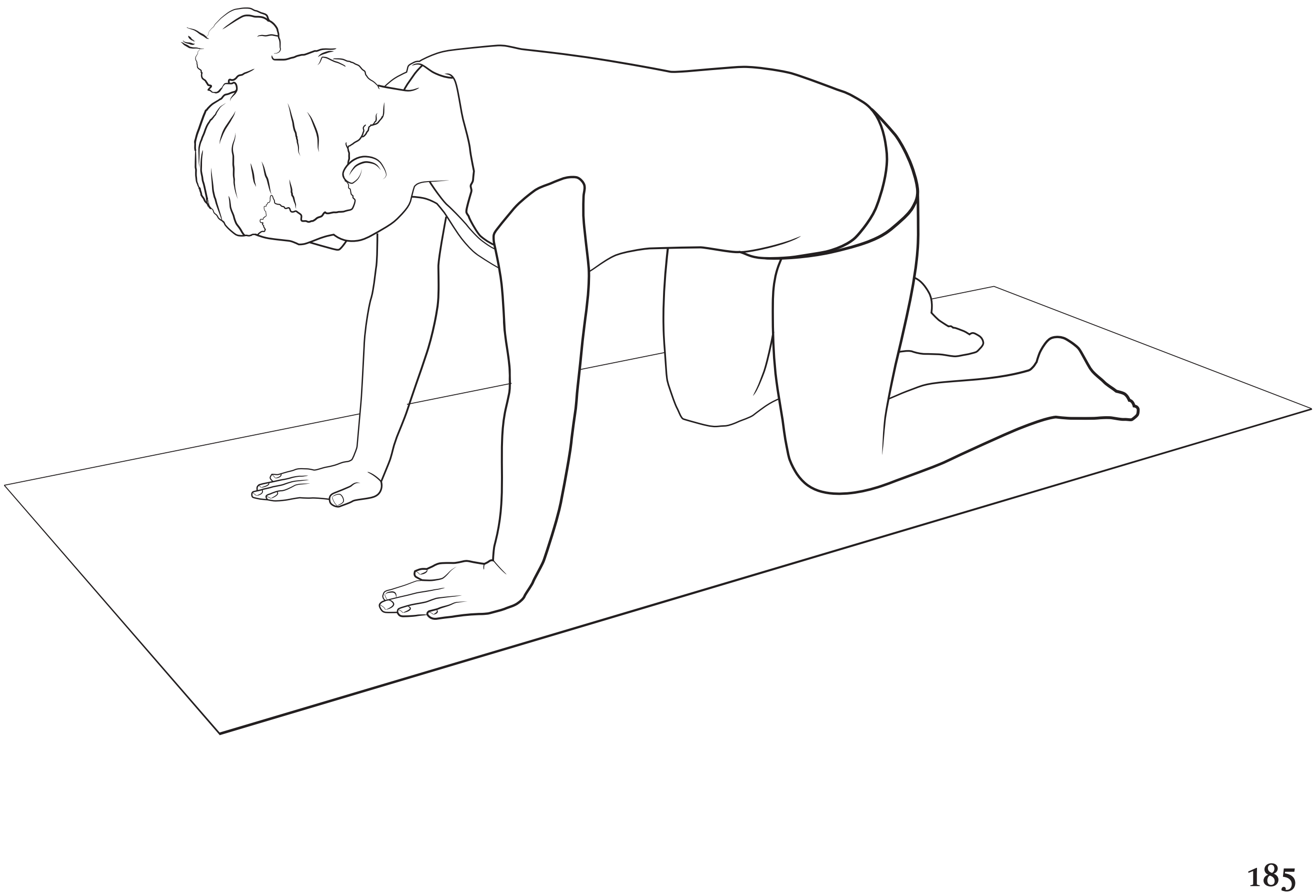




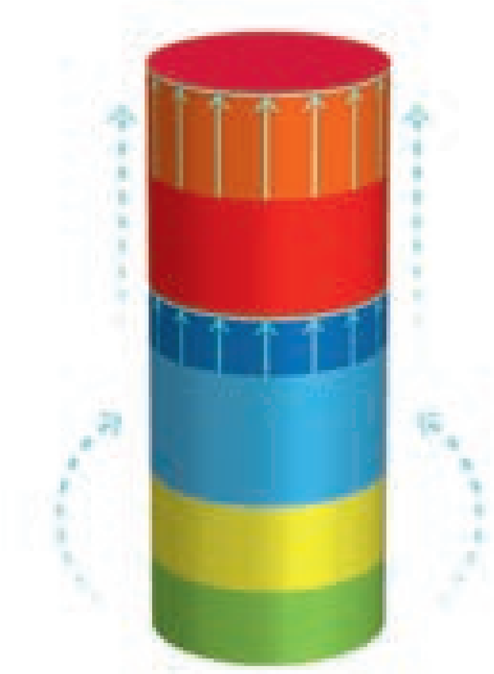








Neurophysiological view of the program for "movement repair"



- Influence of the implementation of stimulation with the Vojta method or VM2G method in healthy individuals
- Basic operating program of motor skills grows and becomes robust
- This improved the conditions for application programs, their growth, development and precision

Reflex stimulation

Another group that has tolerated VM2G therapy safely includes elderly patients, even after the ninetieth year of life.

VM2G has been proved to be beneficial in sports medicine, not only as an instrument for posttraumatic physiotherapy, but as an instrument for physical regeneration and for improvement in specific sport abilities.

VM2G has been also beneficial in patients with neurodegenerative disorders, like multiple sclerosis. The therapy has been beneficial in patients with developmental disorders of skeleton, e.g. scoliosis, chest deformities, etc.

VM2G therapy has served patients in various stages of immobility, including comatose states, very well. It improves ventilation functions, including normal evacuation of bronchial mucus; it improves food intake, digestion and

Video

Strong response
to exercise
bit.ly/2oJZtTG

Video

Strong response
to exercise
bit.ly/2npBat5

Illustration of the pathological posture of the fingers of the right hand to ulnar deviation

defecation. It prevents the initiation and development of immobilisation syndrome.

15.2
New Psychological Approach within VM2G Therapy

The therapy of infants utilises the psychological approach that respects the specifics of communication in this period and the findings of developmental psychology. Use of technical aids significantly reduces the positional insecurity of infants that alone can induce psychic discomfort in the child.

Technical aids increase the inducement of a reflex, but the stimulation pressure on the

Training suit for infants

zones only needs to be small. This eliminates the risk of the child perceiving the experience as painful.

Therapeutic guidance of mothers of the infants is targeted on good communication with the child during the exercise. It prevents the development of negative perception and subsequent aversive reaction to the therapy itself.

A carefully planned and non-aggressive psychological approach to the therapy in preschool children and children with autistic disorders has been beneficial. Slow habituation of the children to the stimulation with stimulation balls, which takes place at home, brings good results. Children gradually get used to the whole situation, they can perceive the freedom of own choice and they can stop the therapeutic stimulation any time. Thanks to this experience, they get used to the therapy and stop fighting back because they know nothing is going to happen against their will.

Another remarkable benefit of this approach is that the child gets full, intensive and focused attention from its parents. This experience leads to gradual habituation. The children consent to the therapy easily and sometimes they even ask for the therapy themselves.

For an adult patient, there is an important possibility of active attendance of the close family members during the VM2G therapy. They are not in a passive role of recipients of expert care. They participate in their healing with their own activity or alternatively with the activity of their relatives. At the same time, they realise the possibility of building sufficient physical endurance to future stress and that is very motivating for the VM2G therapy, too.

15.3 Application of VM2G in Newborns and Infants

15.3.1 Psychological Specifics within VM2G in Newborns and Infants

In the therapeutic relationship developed within the Vojta method, the stimulation is a very strong incision into the mental state of the child because the therapist touches the child physically. Consequently, the child experiences a myriad of feelings it hasn't come across before. These feelings are closely related to induction of the global reflex through stimulation of reflex zones. Consequently, tonic and locomotive muscle activity is induced in the whole body. As the activity is a reflex in origin and independent on the child's will, it must initially cause mental confusion.

According to observed initial reactions, we think it's confusion and anxiety. In every moment of uncertainty, any child, be they new-born, infant or older, looks for explanation and help from their parents. In this situation, positive cooperation between the therapist and the parents may play a key role because well-informed parents can stand close to their child, calm it down and reassure it that nothing wrong is going on and everything is going to be fine again.

Dyadic interactions, nonverbal and verbal communication between parents and the stimulated children should lead to gradual habituation. The child should learn to ignore the stimulus that has become known and that hasn't had serious consequences. The goal is to make a ritual and not a necessary evil of the time spent together during therapy.

If the therapy could become a ritual for the child and the parents, through which they can pay undivided attention and enjoy physical closeness to each other, the stress and imposition would be perceived less by all family members involved.

What can contribute to making the therapy a positive ritual? The preconditions consist in correct understanding of the meaning, purpose and goal of the therapy; properly learnt technique; the ability to implement it confidently and to control the physical expressions induced by the stimulation; good time management and schedule of the activities throughout the day to prevent the time stress. It is important to keep in mind that therapy of infants must be performed 4 times daily.

The highly efficient method of prevention from burnout syndrome and physical exhaustion of the mother, who is the parent most often exercising with the child, is to regularly engage a close person, i.e. father, grandmother, etc., into the therapeutic process. It's necessary to consider that successful therapy often requires several months of stimulation, which may cause not only mental and physical exhaustion of the mother that has no alternation, but also disorders from overload, i.e. inflammations of insertions of extensor muscles of the hand, e.g., tennis elbow.

Initially, the therapy is practiced briefly, during breaks. The child should be taken into a care-giver's arms and assured that everything is alright and that nothing uncomfortable is going on.

During therapy, eye contact should be made and maintained within the adequate distance the child can focus on to see our face. Throughout the stimulation time, it's very important to catch the attention of the child by talking. Nursery rhymes, poems and songs are very popular. Children taken by the melody

Video – Technique of stimulation of the infants with VM2G

Care of the mental comfort of the child and the mother during the therapy
bit.ly/2onjEuj

Illustration of intensive eye contact between the mother and the child.

of the voice get used to and consent to the stimulation sooner.

In terms of therapeutic approach within VM2G therapy for infants, it's necessary to consider the findings of developmental psychology of early childhood. The therapist must actively and sensitively lead the parents to recognising

Video – Technique of stimulation of the infants with VM2G

Eye contact between the mother and the child
bit.ly/2o6OwhL

the child's reactions and not to hurry with the "commencement" of the therapeutic stimulation until he/she is sure the parents have understood the approach that should be practiced with their child. A reckless approach to therapeutic intervention, which is still practiced sometimes, is inappropriate in terms of results of the therapy and the cooperation of the parents.

From the very first weeks of life, the child has been creating the image of its surroundings and searching for "adequate and useful" reactions to them. The time invested in the establishment of the contact among the therapist, the parents and the child in the beginning of the therapy is going to pay off in the future. Because of the slight anxiety of the parents in the early phases of the therapy, we have found it to be beneficial to establish email communication, so parents can ask about uncertainties in implementation of the stimulation or responses to it. Prompt answering of the questions guides them smoothly out of helplessness and reduces their anxiety.

15.4 Learning And Long-Term Memory In Infants

For long time, there was prevailing opinion that children younger than 8 or 9 months cannot keep the information in the memory for no longer than a few seconds; refer to Jerome Kagan, 1989[23]. The recent research indicated that this idea has been wrong. Based on observations of David C. Rubina,[24] we can assume that the circumstances create the first entry

23 KAGAN, Jerome. Unstable Ideals.
24 RUBIN, C. David Understanding Autobiographical Memory. Cambridge University Press, 1986. ISBN-13: 9780521189330

towards the recognition of the target indicator.

Collected data indicate that small infants can quite precisely remember what they have learnt and they keep the knowledge in the memory for days or weeks and not seconds or minutes, as was presumed. Although the indicators of revoking the memories in infants are extremely specific, the amount of information within the context that slowly integrates into their memories, increases during the first six months of life. It has been found that infants of 3 months of age are sensitive to information from context. This is the opposite view of the common opinion that says the hippocampus, which most probably processes the information concerning the space and disposition of the place of the respective event, is not active before the end of the first year of life (see also Diamond A.)[25]

The infant is not only a pupil that automatically creates connections. He/she is also an active pupil who can remember for a long time, what he/she has learnt. He/she can also benefit from the learnt knowledge and perform more difficult tasks that would require recognition processes of foreseeing and anticipation. Moreover, although very dependent on its surrounding, the infant is not only a passive pupil, but a very active one, as evidenced by their facial expressions and the sounds they make, when they're content with accomplished task or dissatisfied with failure. The first instances of learning take place within a context of mutual interaction with the environment.

These findings indicate an important fact for VM2G. If the saving of a "therapy ritual" into the child's memory is to be facilitated, it is necessary to create adequate and consistent conditions for this. The place of training should not change. It is also very useful to create a time schedule of therapeutic exercises; it must be integrated within the child's biological rhythm.

25 DIAMOND, A. Rate of maturation of the hippocampus and the developmental progression of children's performance on the delayed non-matching to sample and visual paired comparison tasks. Philadelphia: University of Pennsylvania Press, 1990.

15.5 Case Study of a Patient with Severe Central Coordination Disorder with Muscular Hypertonicity

15.5.1 Illustration of the Possibilities of a Solution of a Very Hard "Start in Life"

The mother of the patient remembers in her reflection: "Matyášek was born in the 35th week of pregnancy, and he had been our "prayed for" child, who arrived after many problems. He had undeveloped lungs and severe jaundice. Nevertheless, after 3 weeks at ICU and to our great pleasure, we took him home. Like every other child from ICU, he had undergone many examinations, including several examinations by a neurologist. Everything seemed to be alright. Approximately after the postpartum period, I began to notice that he didn't lie flat, but he turned to the side and tilted his head back. It was most apparent in the baby stroller. Within a few days, it seemed to me, he did it more and more but I didn't know what that could mean. When I read the book Tender Parents' Arms several times, I came across a figure of a child bent into a "C-shape". It was written there that these children were exercising with the Vojta method."

The patient, brought to our office by his mother, was among those, who had a very uncertain future at first sight. Neurological reports from the maternity hospital and outpatient visits proved this initial impression. The patient was prematurely born in the 35th week of pregnancy. After changing the diaper, it was apparent how difficult it was for him to only lay on his back. He tilted his head back and expressed his dissatisfaction with loud cries. His mother had taken careful notes, pictures and videos throughout the whole course

of development. Among other observations, she noted: "As late as the end of the second month, I noticed, he had begun to turn to the side and it had tended to gradually worsen." And also: "Sleeping always took place in a tight wrap; the less space, the better." (4th month).

"He always lays on his back slightly curved. He doesn't like the prone position and he doesn't like to lift his head". His head has noticeably grown."

The next examination by the neurologist proved his mother's fears. It revealed very severe central coordination disorder with muscular hypertonicity and excessive growth of the head. Exercises took place at home. They were very intensive – four to five times a day. After several months, the mother's tendon in the forearm became inflamed, and she had to do the exercise with a brace on her hand.

15.5.2 Description of the Problem (clinical findings)

Based on previous medical history, it was apparent that a severe form of central coordination disorder might be present. The first examination we performed in the third month clearly proved that the central coordination disorder was present in a severe form accompanied by overall high muscular tension. The child spontaneously lay in a supine position in opisthotonus. He tried to find a support that had been lost to primitive reflexes. He had no support in the arms. He tilted his head backwards. Primitive reflexes could be induced with extreme vigour, particularly the reflex of Moro. All responses to positional tests were abnormal. The size of the child's head was enlarged, which was confirmed by anthropological measurement.

Conversely, the muscle volume of the limbs and torso were retarded in their trophic development.

15.5.3 Expert Explanation of the Problem

Prematurely born children are at multiple risks, particularly in terms of the impairment of future psychomotor development. Although the first neurological report from the maternity hospital and subsequent check-up described a normal condition, it could be detected from the mother's observations, notes, photos and videos that the development of this child wasn't heading in the right direction.

She wrote down: "Sleeping always took place in a tight wrap; the less space, the better." This is typical of the children with great positional insecurity. It's necessary to recreate a safe positional environment similar to intrauterine life. Positional instability is a source of unrest when falling asleep and sleeping. The children have difficulties falling asleep and wake up easily. These are the clear signs of extremely immature programs of motor skills. They wouldn't let the child assume a resting position that would have been assumed automatically. The position is disturbed by easily induced primitive reflexes. The typical manifestation consists of an effort of the child to secure a stable position by tilting the head back into opisthotonus. To do so, the child uses primitive occipital reflexes.

In terms of developmental kinesiology, it is obvious that the development of the child didn't progress from the new-born stage and the excessive inducibility of the primitive reflexes prevented the progress of development.

Impaired regulation of spontaneous motor skills could not provide a stable position in either the supine or prone position. This immaturity of postural autonomic regulation is the source of the child's mental discomfort. It is shown in crying that could be hushed by creating conditions for the child to secure the position – optimally in the arms and when sleeping by reinforcement in a wrap.

Ongoing programs of primitive reflexology prevent the start of normal motor development. The child's brain "ruled" by primitive reflexology soon starts using a substitute locomotion program for its development. This leads to substitute pathological movement interplays that result in pathological stereotypical movements. This means that basic stereotypical gait, grip, breathing and orofacial movements are impaired. Consequently, gross and fine motor skills of locomotion are impaired with all the subsequent impacts on the musculoskeletal apparatus.

Early and correctly established diagnosis of the state of the basic programs of motor skills based on the developmental kinesiology can show not only the actual condition of the child, but it also allows correct planning of the therapy. This kind of diagnosis becomes a continuous diagnostic tool in the course of the therapy as it can precisely monitor the development of the psychomotor functions and proves the correctness of the chosen therapeutic strategy.

The therapist of infant patients has to be an excellent diagnostician. The therapy within VM2G is targeted on normalisation of motor development in accordance with teachings of developmental kinesiology. Consequently, it should result in the deactivation of the substitute kinetic program without impairing the regulation of muscle coordination, as this would cause the utilisation of substitute pathological stereotypical movements.

Primarily, the therapy must "switch off" the substitute program of motor skills so that the "loading" of the physiological motor program would be enabled. Consequently, the normal development of the musculoskeletal apparatus could be started.

15.5.4
Illustration of the Solution

After 16.5 months of intensive exercises four times a day, they were changed to maintenance exercises of one item two times a day. There was a short-lived problem with sabre-shaped lower legs. The therapy has been completed after the following four months. Retrospectively, it's been counted that almost two thousand exercises were done! What an extremely impressive feat! Motor development completely normalised in the 23rd month of the patient's life. His mother has described all struggles in her reflection accompanied with many photos and videos. These materials represent a comprehensive view that reflects the course of motor development of the patient.

15.5.5
Explanation of the Solution

Despite the severe initial status confirmed by repeated neurological examinations, the patient has been guided out of the dangers of false motor development to the completely normal function of the musculoskeletal apparatus in all its components. We cannot conceal the fact that the therapy itself was extremely difficult for both the parents and the child. Twenty months of the therapeutic process and almost two thousand exercises speak for themselves. This all required a strong will, discipline and self-denial. It's interesting that during this intensive therapy the child practically wasn't ill in terms of common colds, respiratory inflammations or intestinal problems.

The implementation of VM2G started the reparative processes in the CNS. In this case, the stimulation activity was targeted on the processes within the CNS, neurogenesis in particular, and on prevention of apoptosis. Due to the utilisation of genetically determined motor programs, it is possible to perform the stimulation with maximal efficiency without the risk of overload. This plays the key role in children with severe central coordination disorder.

Notes of Patient's Mother
1st month
Refer to report from the maternity hospital.
2nd month
As late as at the end of the second month, I noticed that he began to bend and that the condition had worsened.

3rd month
We have started to exercise. We attended the neurological department three weeks after the commencement of exercises. The condition was improved then, and he didn't lie in such bent position. The photos of Matyášek lying naked have been taken on a day of the commencement of therapy to enable a comparison. Sleeping always took place in a tight wrap; the less space, the better...
4th month
He still lies slightly bent and doesn't lift his head up. He doesn't like the prone position. His head has noticeably grown .
5th months
Because of my acute gallbladder surgery, Matyášek was at home only with the father and on artificial nutrition. (He was fully breastfed before and afterwards.) For two weeks, he trained exclusively with his father, who knew the right method of exercise. Nevertheless, Matyášek wasn't used to exercising with only his father. His condition worsened. Previously normalised reflexes reappeared. Because of suspected hydrocephalus, we had him examined by a neurologist. At the end of the month he began to elevate his legs when in the supine position.
6th month
In this month, Matyášek started to lift his head. He was lying on the side during play and started to put his feet into mouth.
7th month
At the beginning of this month he began to turn on his belly.
8th month
He lay totally straight in the supine position then. One hemisphere had subsided, so only one leg was bent.
9th month
In this month, he started to raise himself on his hands in the prone position more often, and he began to crawl. Detail of crooked toes. This month he gained much weight. Maybe that's why his development has improved significantly.
10th month
Crawling got faster, see the picture of the feet.
11th month
Sometimes he got into the position on all fours, but his legs were too spread and his back too bent.
12th month
He wouldn't sit; he wouldn't crawl on all fours; he would just crawl on his belly. He started to climb up to slightly elevated surfaces.
13th month
He gained much weight this month. Maybe, that's why he made such great progress. He stood up for the first time, but with a very bent back (Harrison's groove). He began to sit and knee. He could get on all fours, but the back was still curved. Sometimes he held his feet together.
14th month
He still just crawled. We had found out accidentally that he could crawl on all fours well, but only on the mound. He could stand without a bent back and he started to walk along the furniture. He was really sure when sitting, kneeing and standing. He didn't fall at all.
15th month
In the beginning of the month he began to crawl on all fours. He still crawled on his belly, only less. The feet were spread apart too much while crawling on all fours and the back was too bent. We tried to wear shoes, but he didn't like them. Hence, he lay down on his belly from the sitting position.
16th month
At the beginning of the month he took three steps and later added more. Consequently, he could walk at the end of 16th month.
17th month
Training of gait. Fine motor skills are excellent – see the photo next to PC.
18th month
Improving the gait.
19th month
After 16.5 months of intensive exercise, we changed to maintenance exercises. Only

2 times a day, 1 exercise. There was momentary problem with sabre-shaped lower legs.

20th month

He could sit in the chair beautifully in the upright position. Taking photos got difficult. The subject was always running from the shot…

21st month

The sabre-shaped lower legs normalised, so we exercised 1 item once a day. Now there was a problem with crooked Achilles tendons and collapsed foot archest.

22nd month

For soft motor skills, see the picture with the screwdriver when he hit a small screw. The gait was fine, sometimes he turned the tips inwards. Rough terrain made no problems. Compared to his coevals, he couldn't manage to ride a pushbike. He couldn't run so well, but otherwise, everything was comparable.

15.5.6 Reflexion of mother of small Matyášek

Matyášek was born in the 35th week of pregnancy and he had been our "prayed for" child, which came after many problems. He had undeveloped lungs and severe jaundice. Nevertheless, after 3 weeks at ICU and to our great pleasure, we took him home. Like every other child from ICU, he had undergone many examinations, including several examinations by a neurologist. Everything seemed to be alright. Approximately after the postpartum period, I began to notice, he didn't lie flat, but he turned to the side and tilted his head back. It was most apparent in the baby stroller. Within a few days, it seemed to me, he did it more and more, but I didn't know what that could mean. When I read the book *Tender Parents' Arms* several times, I came

across a figure of a child bent into a "C-shape". It was written there that these children were exercising with the Vojta method.

Since I've always been ready to take action, I didn't hesitate to find a solution. It was a weekend and Monday was far away. I consulted the problem with my friend, who'd used the Vojta method with her son. I got the contact of Mr. Krucký. I called him on Monday and booked a consultation appointment for us on Friday. On the same day, I visited our paediatrician to get the request form. She had been replaced by another physician that day. He acknowledged that our son was extremely physically impaired. He filled in the request form and we didn't have any other problems to deal with together. It was "D" day, and we attended the consultation, which couldn't get any worse. Our two-month old son was at the level of a new-born. That was a blow out of nowhere! I was crying the whole way back home and the whole weekend through. My husband tried to help me to cope with the news and to find new optimism. As I look back, we hadn't even known what was at risk. We just wanted our Matyášek to be all right. Although I had unfortunately gone through quite a lot with my health conditions, this hurt me a lot – my child had to be healthy! So, we started to use the Vojta method. First, there was one exercise 4 times a day. Since the very beginning we've been very responsible, we've exercised regularly with no break. Initially, I thought to myself, there was nothing special about the Vojta method – it seemed very easy to do. Matyášek was very clever and coped with it bravely. He didn't mind and didn't cry. After three weeks of training, we saw the first signs of progress. He didn't bend so much and lay straight sometimes. During one of our follow up visits, Mgr. Krucký pleased us with the findings. He said Matyášek could maintain eye contact for a very long time and that it was apparent that he was smart. I had thought to myself that if he were handicapped I would have coped with it somehow, but I still hope he wasn't mentally challenged. Apparently, he wasn't, which was great! The number of exercises grew and I discovered that the Vojta method wasn't as simple as it first seemed. On the contrary, I had to plan beforehand, how each day would be scheduled so that we would manage to exercise 4 times a day. I had to keep in mind that Matyášek shouldn't do the exercises soon after meal or when tired. I always had to manage the errands and the places where we had to be on time. Sometimes it was difficult, particularly with the visits to the physicians in another town. The paediatrician sent us to a neurologist when she found out that I had sought a physiotherapist and used the Vojta method. When I told her that at the age of 2 months he'd been at the level of a new-born, she replied that it wasn't true, that the physiotherapist had only scared me and that "these" children looked different... The neurologist also determined that Matyášek was essentially healthy, although I mentioned that he'd improved remarkably since the beginning of the exercises. We still didn't properly know what was at risk. When somebody asked us why we exercised and what would have happened to him, we used to answer that he might have had a deformed back or walked incorrectly, etc. A lot of people thought, we were exaggerating the problem because his condition hadn't been so noticeable in the past; their children used to have similar problems, etc. Our family was supportive (although as time went on, nobody wanted to visit us at the time when we were exercising). And when it happened, for example, grandpa always left with absolute regularity because he couldn't witness this "torment". Sometimes, the exercises were pleasant, but as the time went on, they were always accompanied by powerful screams and cries. We live in a block of flats, and I often used to think that neighbours were going to inform the social department because the boy's crying didn't correspond with babies' ordinary crying. Matyášek got better and his development had started well. He still liked to be wrapped tightly, the less space, the better. We attended the check-up visits every two months, and we looked forward to the next ones because each new visit meant the end of therapy was drawing closer. Initially, Mgr. Krucký had told us that children usually ended the therapy in about 8th or 9th month. So, my husband and I had set a goal to exercise until spring. We just needed an idea of an end. My husband and I both exercised with Matyášek. I have to say this was a great help for me personally because I knew that it all wasn't up to just me. My husband had an extremely time-demanding job, but he exercised with our son at least once daily. Moreover, he got much closer to Matyášek during the exercises. Our son loved the singing and talking during the exercise. When I exercised with Matyášek, I didn't mind the screaming. However, when my husband was exercising with him, I preferred to leave for another room. Following the first tearful weekend in the beginning, I was very positive and wouldn't admit failure. Nevertheless, I couldn't read about the development of the babies. I knew that Matyášek was behind, but I didn't have to read that in this age he should have been able to do this and that. In the fourth month, he still didn't lift his head and he didn't like the prone position at all. Everything was going smoothly until I had to be taken for the surgery. For the first two days, I had Matýsek along with me in the hospital, but after the surgery, he stayed at home with his father. The fully breastfed four-month old son became a child on artificial nutrition. But they managed well. After 2.5 days, I could be at home again and we returned to breastfeeding. Moreover, at this time he started to lift his head and we were looking forward to another rehabilitation to show off our progress. Suddenly, it was all different and there came another blow – Matýsek's development stopped and even worsened. The new-born reflexes had reappeared. The prone

Photos – Videos

Matyáš Koukal
bit.ly/2nKioQG

position didn't mean he lifted his head. He was bending his back, and the situation was severe. An immediate neurological examination was recommended and very severe neurological problem was suspected. Again, I was crying the whole way home and the whole following weekend. I was terrified, alarmed and totally wretched. Right on Monday, I ran to see the paediatrician to get the recommendation for a neurologist. After explaining our situation, she basically told me off. She questioned the place of our treatment and accused the specialist of being a charlatan! She wanted to see Matyášek in a prone position and examine him. She praised him for lifting his head and after the disagreement, she gave us the request form for the neurological examination. The neurologist wasn't so enthusiastic about the condition of our son. She acknowledged that his prone position looked horrible and the assessment wasn't based on how he lifted his head. She sent us for an ultrasound of the head, while other examinations could have been performed under general anaesthesia. To make a long story short, we went through a month of terrible stress, but luckily, the diagnosis wasn't confirmed. In retrospect, we really think this it was caused by our detachment. Still, the neurologists didn't want to tell us the prognosis. They said it was necessary to wait and see what was going to happen. Until then, the diagnosis shouldn't be determined. All this time, we trained intensively and at the end of the 6th month, Matyášek really started to lift his head and even to like the prone position. What a joy! After about five months of intensive exercise, my first "training crises" appeared. We were still training in earnest, but for about a week I stopped to use balls and elastic nets. I felt an utter aversion to them as it always took too long to use them during the exercise. It was apparent that, following the deterioration, we couldn't expect the therapy to end in spring. Thus, we moved the date to summer. By then we had six months ahead of us, and I was sure everything would be as it should be. There was no way we were exercising over the summer while on holiday… Matyášek started to raise his head in sixth month. One month later, he started to turn on to his belly and in the 8th month he started to belly-crawl. We were so happy about each advancement, which gave us the strength to keep on exercising with him. In the 8th month I asked Mgr. Krucký, if he could tell whether Matyášek would walk in the future. I expected a direct answer and was very surprised to hear that it couldn't be predicted yet. I started to sense that it could be cerebral palsy we were trying to prevent by exercise. I had always thought that children with cerebral palsy were born with impaired limbs – after all, anyone could recognise cerebral palsy. After reading a certain article, I realised I'd been wrong. The limbs tend to bend in time, when the muscles couldn't be used. Possibly from the 9th month, our exercise began to be physically demanding. Matyášek fought back and tried to get out of the positions. My hand started to hurt because of tendonitis. I had to tie them up and strengthen them during the nights to be able to exercise the next day at all. I used to exercise in pain and, sometimes, with tears in my eyes. But it had to be done. After the next month, my condition improved, but I had to protect my hands. Basically, they weren't completely healthy until the end of the treatment. The summer was near and it was clear to us that we would have to move our target date. At one year of age, Matyášek couldn't sit, he still only crawled. Two days before his first birthday, we visited the rehabilitation department again. And we got the best birthday present possible. Only at 10 months of rehabilitation were we told the truth: Matyášek really was at risk of developing cerebral palsy affecting both legs and one arm, the prognosis was severe and it seemed that Matyášek would

Home therapist during the supervision check-up at the office.

have to remain handicapped. But at the age of one year, the risk of cerebral palsy was over! We were absolutely overwhelmed by euphoria for several days. I felt like I was walking on air. I was thinking, whether I would have wanted to know about the risk from the beginning. I like to know everything, and I minded the secrets, which the neurologists kept during their check-ups. Fortunately, we took the exercise seriously from the very beginning and trained as we should. So, we didn't mind, we hadn't known the truth. But I suppose, for many people, this might have been a stumbling-block, and they wouldn't have exercised the way they should have. We continued with the exercise, although it was just a "cosmetic issue". It was summer and we went to the cottage and on vacations and trips. We continued to train four times a week. Sometimes, it was difficult. But you do what you have to do. A specially manufactured tilted exercise mat travelled across the part of Europe along with us. Matýsek made great progress during the 13th and the 14th month. He sat and began to stand up, but his movement was limited to just crawling. In the beginning of the 15th month he surprised us by crawling on all fours! It was absolutely unbelievable as we'd waited for it for so long. In the beginning of the 16th month, he took three unaided steps. The following week, he took five steps, gradually taking more. Then, he stood without support and we expected the moment he would start to walk. The vision of the accomplishment of the therapy was so near.

At the beginning of the 17th month, Matyášek began to walk! We all were so thrilled, rejoicing that we could look forward to the end of exercise. But the end hadn't come yet. The gait wasn't perfect, so we had to improve it. After 13 months of intensive exercise, we got rid of the worst exercise – on the belly. Suddenly, the exercises were easy to do and completed quickly. I have to admit, that I had a minor "exercise crisis" again and for some time I trained without balls and elastic nets. Matyášek was 16 months old. During the exercise, he was pulling the balls. He didn't like to wear them. He took them and threw them away. Throughout the whole course of the exercise, there were many unpleasant moments and moods. Sometimes we argued with my husband, who should have exercised that day. We would have rather do the least enjoyable activities to avoid exercising. Many times, I didn't want to exercise, I postponed it and shifted it around during the day, which spoiled the mood. Several times, I wanted Matýsek to sleep as long as possible because the idea of exercise after getting up frustrated me. My husband also "blew up" during the exercise sometimes and said he was done with it. It was impossible to keep Matýsek in a position. He pulled on the balls. The elastic nets slid down.

The rehabilitation was extremely difficult, but thank God for it. What value would there be in a year of exercise, if Matýsek wasn't able to walk and had instead stayed wheelchair-bound? We are so thankful for the method that could make life better for our littlest ones. Why wouldn't we do this for them! In our case, there was an obvious maximal progress and improvement. The potentially handicapped little boy has become healthy. He can run around as he pleases. It takes a lot of strength, effort and patience, but it's worth it for sure! We have to thank our physiotherapist Mgr. Krucký so much for his proper leadership in the exercises, great deal of useful advice and findings and excellent approach to our son. He had difficult times too – the very moment Matyášek saw him, he started to weep heartbreakingly, as he realised what he was up to. The doctor had to hide to stay unseen to let Matyášek act naturally. For a long time, we attended the visits with the video camera because Matýsek wouldn't show anything at the office. Christmas was near, and we were looking forward to a special present – the successful completion of the rehabilitation. The joy didn't come. We moved the deadline again. Maybe, it would come by the next visit next month. It had to come one day. And it almost did – at the next visit at 18.5 months of age, the exercises more or less ended. We didn't have to exercise 4 times a day. One exercise 2 times a day was enough. Anyone who has ever trained will understand why we saw it as the end of therapy. Matyášek still had sabre-shaped lower legs – a condition that should improve with growth. Thus, there was the maintenance exercise. We had a party together because we got to this point after 16.5 months of intensive exercise. We could enjoy the whole day We didn't have to plan. We managed to do everything on time. We were thrilled because the morning and evening exercises took just a little time. After a month, we didn't feel like keeping up with the training, but we remained determined to follow through to a successful end. The progress was apparent. We hoped D-day was near. I have to say, I'm glad I didn't know how long we would have to exercise for. Due to my profession, I couldn't help to calculate how many times we exercised. And I arrived at a terrible number – 1,980 times! This is a decent sport performance! We haven't finished yet, but this minor exercising is not worth counting any more.

15.6 New Approach to Management of VM2G Therapy

Due to new approach to management of therapeutic interventions, VM2G has become easily accessible. The model of exercise of the mothers with infants under supervision of the therapist implemented by Dr. V. Vojta in the 1950s wasn't well understood at that time. The results showed that in practice it's been the only functional model of care of the infants at risk of incorrect motor development.

This model delegating the practical therapeutic stimulation to relatives of the patients under regular physiotherapeutic supervision seems to be extremely beneficial within VM2G. Within this organisation of practical implementation of VM2G, it is possible to take care of significantly more patients than could be manageable within conventional physiotherapeutic practice. Concurrently, the implementation of the stimulation is secured on a daily basis for several months or years. Such physiotherapeutic care wouldn't be possible in common healthcare facilities.

Care of *home therapists* represent a model of therapy that has been experienced in child patients with developed pathological findings of the musculoskeletal apparatus, cerebral palsy in particular. Often, it's too difficult for the parents of the handicapped children to provide regular home rehabilitation. The basic home care of a handicapped child is so exhausting that the parents give up the home rehabilitation soon or later. This has unfavourable consequence for the development of these children. Often, it leads to restriction of their mobility.

Home therapists are well-trained. They take care of four to five patients at a time. Home therapists provide the care during office hours. The children obtain their care at home, at the kindergarten or at school they attend. In the summertime, the visits at the cottages of their grandparents can be possible. A home therapist attends the regular supervisions at the office with their patients. This secures continuous and gradually intensified physiotherapeutic care. This service is very beneficial for the family of handicapped children.

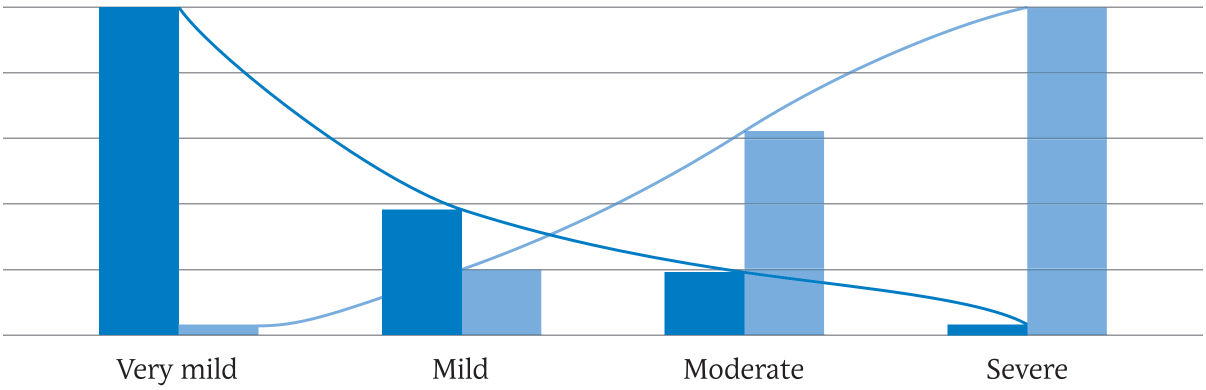
Home care service is also available for adult patients who haven't had the possibility to undergo home care with close relatives or friends. We found the possibility of implementation of video streaming technologies and saving of the therapeutic sessions with the home therapist to a server to be extremely

Videos – Samples of therapy

Byrtus Daniel
bit.ly/2nWOfit

Byrtus Daniel
bit.ly/2nVwGy9

The degrees of central coordination disorder



Reduction in frequency of CCD is related to increase in its severity, and conversely, the severity of the disorder of the dynamics of the primitive reflexes increases with their frequency.

beneficial. This allows remote management of the quality, the method and the reflex response during therapy.

Home therapist during the supervision check-up at the office.

15.7 VM2G – Therapy in the Children at Risk of CCD (Central Coordination Disorder)

After 10 years of VM2G practice (since 2006) more than one hundred infants have attended my office. They were admitted due to suspected risk of incorrect motor development, i.e. CCD. The development of most of them has been documented on video.

The results of two cases concerning infants are extraordinary among others. One of them was diagnosed with a rare congenital metabolic disorder and entered a vegetative state. The other suffered asphyxiation during delivery, but was resuscitated after about 10 minutes of apnoea. The magnetic resonance imaging of the brain showed necrosis of practically all cortical areas. However, the implementation of VM2G prevented the development of any pathological changes of their musculoskeletal apparatus in terms of spastic transformation of the muscles, shortening of tendons and collapse of the chest of malfunction of the diaphragm. Due to these results, the care of these handicapped children is significantly easier.

A whole spectrum of degrees of CCD occurred in other children. As supposed by V. Vojta (1991)[26], the children with very mild or a mild degree of CCD could be successfully guided towards normal psychomotor development. In moderate degrees of CCD, it could be expected that the development of the child bearing such risk could be accompanied by some motor problems. Beside these motor impairments, there are often associated disorders in terms of light brain dysfunction, concentration disorders and subsequent disorders of a wide spectrum of specific learning disorders (i.e. dyslexia, dysgraphia, dyscalculia, etc.). It is confirmed by long-term practice and often supposed in children at risk of a severe degree of CCD

26 VOJTA, Václav. Vojtův princip. Praha: Grada, 1995 ISBN 80-7169-004-X

that their development would head towards some type of CP. The Vojta method has been mostly successful in alleviating the degree of affliction, i.e. the development stabilised at diparesis instead of quadruparesis.

15.7.1 The View of the Prognosis, Diagnosis and the Therapy if the Children at Risk of Motor Development Disorder due to Central Coordination Disorder (CCD) and Its Solution in Terms of VM2G

V. Vojta (1991) postulated that it could be presumed in most cases of children at risk of a severe degree of CCD that their development would head towards CP, as confirmed by long-term practice.

Therapy with the Vojta method has been mostly successful in alleviating the degree of affliction, i.e. the development stabilised at diparesis instead of quadruparesis. Our experience showed that children who underwent VM2G therapy regardless of the degree of risk of CCD were successfully led to completely normal motor development, i.e. normal bipedal gait.

Of course, therapy in children with the severest degree of CCD was most complicated and longest, but there are no doubts about its efficacy.

Children who had undergone VM2G therapy could be guided to normal motor development and normal bipedal gait, regardless of the degree of the risk of CCD, i.e. children who had demonstrably severe degree of CCD.

Of course, therapy in children with the severest degree of CCD was most complicated and longest, but there are no doubts about its efficacy.

16. VM2G – Therapy of Children Affected by CP (Cerebral Palsy)

The therapy of children who have been already affected by completed CP syndrome at the time of admission to our care is significantly more complicated compared to children at risk of CCD. The older the children are and the severer the affection is, the less successful the effort to improve their condition could be. It's not possible to perform as intensive therapy with older children as with infants. The infants are stimulated by VMG mostly four times a day. In older children, we have to get by with therapy implemented once a day in most cases. Ossification of pathological stereotypical movements and the corresponding gradual increase in joint subluxations and deviations of bone axes makes the achievement of the therapeutic goals significantly more difficult. Still, in preschool children and children of younger school age, the long-term and carefully led VM2G can achieve incredible results. The engagement of "home therapists", who help to bring some relief to the families of afflicted children, proved to significantly ease the implementation of the therapeutic process as the daily VM2G stimulations lead the children to the improvement of the condition of their locomotive apparatus.

Video

Kateřina
bit.ly/2mXVtCM

16.1 Economic and Social Aspects of Practical Implementation of VM2G

CP belongs among the most expensive diseases of musculoskeletal apparatus in children. Multiple expenses consist of direct medical expenses, concerning also social and transportation expenses, the costs of medical aids. Other indirect financial impacts include the reduced labour productivity of the family, expenses of the family and the relatives, the costs of psychological care of the patient and his family and also in the upcoming reduced or the non-existent labour productivity of the patient.

Intangible costs are difficult to quantify because they do not cause any measurable impact on the resources. They include the feeling of pain and torment as well as the following decreased quality of life. Compared to direct costs, it is very difficult to measure indirect and intangible costs with money.

Real costs connected with the illness concern all the costs incurred by society, regardless where they occurred or who bears the economic impact. In terms of social economic policy, they constitute the expenses that are decisive because they provide a complete image of the overall cost of the disease that the economy must bear.

According to a study from 2001 by Bode,[27] the costs on one handicapped patient acquired during his whole life were more than 500 thousand dollars. The incidence of CP is relatively stable statistically. In developed countries, it is 2 – 3 children per 1,000 live births. The conclusion of the study "Costs of Disorders of the Brain in Europe" was implemented in 2011 and published by The European Brain Council in 2012. The study focused on the estimated prevalence of the wide spectrum of brain diseases and on the estimated expenses related to them in various aspects – predominantly in healthcare, social services and within the loss of productivity.

The non-economic benefit of VM2G therapy mainly consists of the change of the angle of view. The attention focuses on the family itself, particularly the effort to maintain quality family background for the care of the handicapped child. Home care of a child with health impairment (predominantly the long-term care) significantly influences the conditions of the family life. In particular, the rehabilitation of the child, which completely depends on the parents, becomes even more demanding in later childhood. It often leads to the decomposition of the family environment marked by long-term exhaustion of the parents. The development of the relationships within the family and the quality of the family background involves the children, particularly – siblings of the patient and the handicapped child. The therapy focuses on the possibility for the families that care for the handicapped child to live a high quality life with all its joys. Thanks to home therapists, who regularly visit the children, the parents can divide their time between their ill and healthy children and live together more as family. The main achievement of social innovation brought by VM2G therapy is the interconnection of the healthcare with a key social aspect.

It saves time for the family and children when the therapy is implemented at home, school or school club. The current model of travelling to rehabilitation outpatient offices is often a great loss of time for the child and for the care providers; time that couldn't be used for leisure activities and with the rest of the child and its parents as well.

Implementation of the home therapy of handicapped children at schools and school facilities leads to recognising the reality of such care by other healthy children. Right at the kindergarten or the basic school, they can experience the acuteness of the necessary care of their classmates. They are being naturally educated how to behave toward physically challenged people and how to communicate with them and what their needs are. Home therapy performed in the child's natural environment provides direct experience as how to non-forcibly help the handicapped ones, healthy children and adolescents in mutual integration.

The continuity of the educational process is often broken by the long-term absence of handicapped children. This is the result of necessary treatment stays at spas or sanatoriums. The stay usually lasts 4 or more weeks. The transport to remote rehabilitation outpatient offices is another problem. Conversely, home therapy excludes such breaks in education. It prevents a deficit in the quality of education. It brings the young people closer to reaching the apprenticeship certificate, graduation or completion of the university. Good education is an essential prerequisite for a good job and

27 BODE, H. Sozioökonomische Aspekte. In: HEINEN, F. Das Kind und die Spastik. Hans Huber. Bern.

the fulfilment of a high-quality life. Our experience proves that continuous systematic and supervised rehabilitative care is a fundamental precondition for gradual improvement of the status of the patient, particularly in building and maintenance of the stable status of the musculoskeletal apparatus. The mental condition of the handicapped child is usually more fragile than in healthy children. The help and support provided by the home therapist gradually confirms the patient's quality of self-acceptance and the acceptance of others in their surroundings. The child is naturally and not forcibly led to acquiring the adequate position within the collective of children, without frustrations and inferiority complex. The long-term forged, strengthened and supervised relationships: home therapist – child; the parent – home therapist creates a valuable bond and an instrument that could help the families and the individuals to get over their difficulties and problems that usually occur in the life of handicapped children.

Video

Adéla
bit.ly/2npNWrn

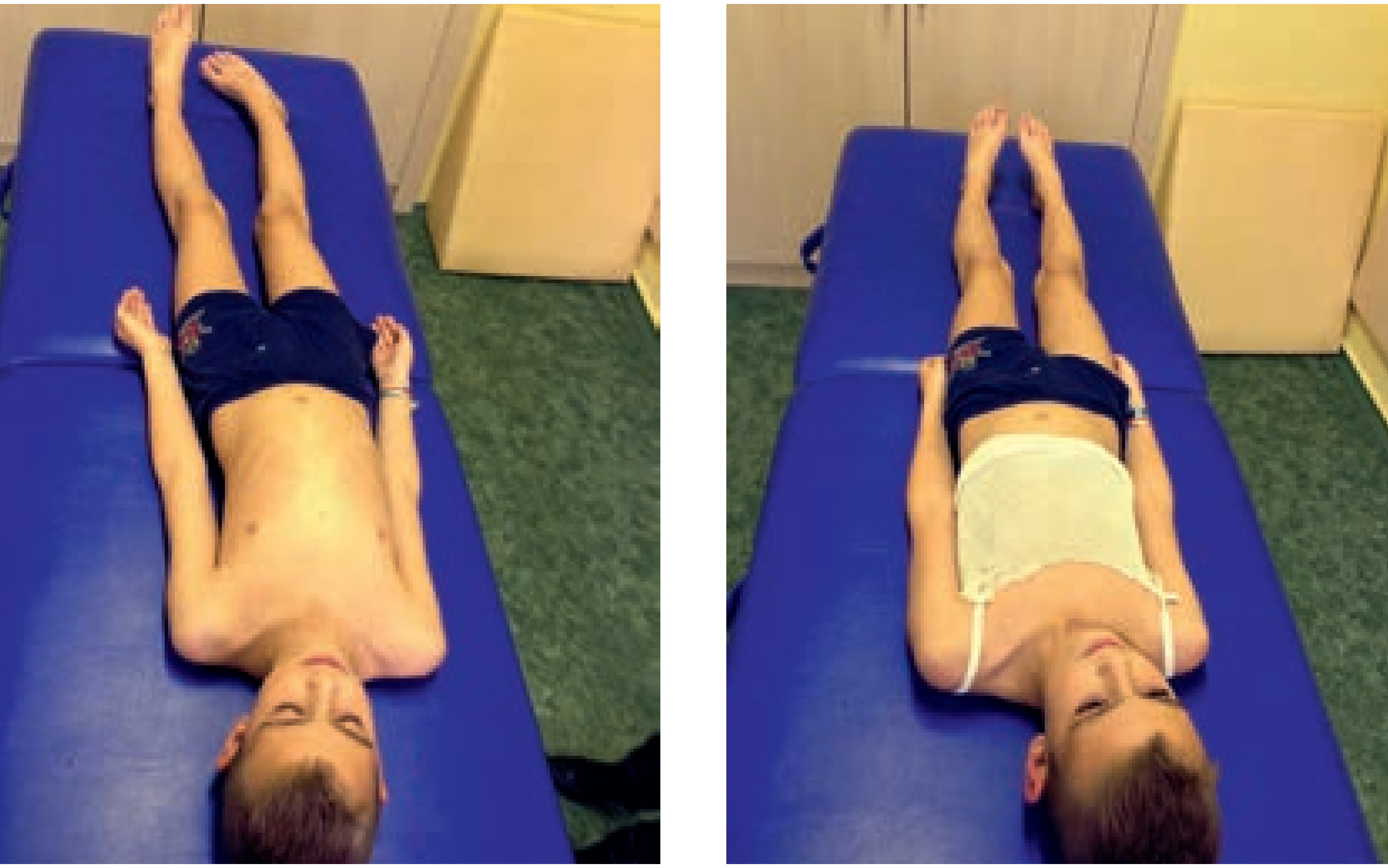


Figure of immediate effects of the VM2G stimulation on the autonomic regulation of the posture of the upper and lower limbs.

17. Practical Part – VM2G – Therapy of Children and Adults

17.1 Basic Terms and Defining Building Blocks of VM2G

The therapy is targeted at:
1. Autonomic regulation of the posture of the body that always contains:
Punctum fixum

- The more there are, the more stable the position.
- The less there are, the more labile the position and the more prone to change; or alternatively the labile position enables the change.

Punctum mobile

- The less there are and the closer to the centre of gravity they are, the more stable the position.
- The more there are and the farther from the centre of gravity they are, the more labile the position.
- **Puncta fixa and puncta mobila create spatial geometric objects that fundamentally aim to make the centre of gravity of the body stable or labile**
- **Initially, transitional phases from the stable position to the labile position and back to the stable position are performed only by the basic stereotypical movements**
- **The regulation of the transitional phases happens automatically and unconsciously. It is provided by the basic operating program of the motor skills.**
- **Subsequent motor learning happens partially unconsciously through gaining of the motor experience, and partially consciously through motor skills learning that enable development of the extension application programs**

2. Autonomic regulation of joint centration
Happens completely unconsciously
It is an integral part of the following:

- Automatic regulation of the posture of the body
- Basic stereotypical movements
- All extension application programs of motor skills

3. Autonomic regulation of the muscle tone
4. Autonomic regulation of the basic stereotypical movements

17.1.1 The goals of therapy are:

- To attain the ability of the body to assume a position within the space that would ensure dynamic stability of the its centre of gravity with the potential of transition to a new position.

- Transition to the new position is highly efficient in terms of energy output. It utilises the kinetic energy of the centre of the gravity of the body and the centre of the gravity of the limbs. It is apparent that the performance of the transition is a highly-coordinated process of practically all muscles of the body.

- To perform an effortless motion that is perceived by an external observer as a harmonic and aesthetic movement – see the dance, ballet, gymnastics of figure skating

17.1.2
Disorders of autonomic regulation of the posture of the body subsequently lead to:

- Insufficient extension of the spine
- Impairment in creation of its physiological curvature
- Disorders of rotation in individual segments and the particular key points:
  - In craniocervical transitional zone
  - In cervicothoracic transitional zone
  - In the thoracolumbar transitional zone

17.1.3
Influences of the impaired autonomic regulation of joint centration

- **The impairment develops through the deviation of the joint axes; it is**

manifested in the statics and the dynamics of the musculoskeletal apparatus.

- **The disturbance happens because of external causes:**
  - The disorder of the regulation of the basic motor programs (cerebral palsy, stroke, multiple sclerosis)
  - The disorders of regulation of the extension application programs (distortion of the form of motion, overload, immobilisation...)
  - The disorders from general degenerative causes (arthrosis, muscular slackness, osteoporosis...)
  - The disorders based on the traumatic changes (both HW and SW), diseases (neurodegenerative diseases), malnutrition...

- **Normalisation of the autonomic regulation of joint centration is essential and necessary precondition of the correct function of the basic and extension motor skill**

17.2 Case Study – Possibilities of Intensive Therapy in a Female Child Patient with Severe Central Coordination Disorder

17.2.1 Illustration of the Central Coordination Disorder, Hypotonic Type

Eliška was brought to our office by her grandma as an infant at the end of the girl's ninth month. The girl didn't show any interest in the world around her. She didn't even show any signs of perception. She lay in supine position without any effort to move or a reaction to the stimuli. She was generally weak.

Grandma couldn't conceal that she had only encountered hopeless prognoses about her granddaughter. She had to fight for the recommendation of rehabilitative care.

17.2.2 Description of the Problem (Clinical Findings)

The history evidenced a very unhappy beginning of life of this small patient. Her mother was addicted to hard drugs and used them during the whole pregnancy. The new-born child quickly developed withdrawal symptoms. Her growth was generally poor, and she only put on a little weight. Because of the medical condition of her mother, Eliška has been entrusted to the care of her grandmother.

Neurological findings uniformly showed very severe brain damage and the development of central coordination disorder, of the hypotonic type. In the ninth month, there was persistence of new-born posture of the body without any basic righting or turning. Because of an inability to establish any contact with the child, who wouldn't react to visual or acoustic stimuli, severe mental retardation was assumed.

The established prognosis was extremely poor due to the stigma experience during the intrauterine life. The development in future months only proved this prognosis. The attending paediatrician considered the initiation of the rehabilitative therapy of the patient as pointless. Only after the grandmother insisted, he sent the child into our care. It was commenced at the end of the ninth month of girl's life.

The performed diagnostics proved there was the most severe degree of central coordination disorder of hypotonic type.

17.2.3
Expert Explanation of the Problem

In Eliška, typical development of the cerebral palsy could be presumed based on a clear cause. Undoubtedly proven factors of the brain damage by neurotoxic influence of the drugs explained the further unfavourable postpartum development. It headed toward the CP of severe hypotonic type, probably stagnating in the apedal form.

This type of neurological disorder is often combined with disorders of mental development. The observed manifestations indicated the development of very severe mental retardation.

17.2.4
Illustration of the Solution

The offered rehabilitative care in a form of VM2G offered hope to the patient's grandmother that it would be possible to do at least something for her granddaughter. She began the therapy with enthusiasm and passion that could be rarely seen. She was convinced that her granddaughter's future was in her hands.

Video

Kilbová Eliška
bit.ly/2oJIFfE

She exercised exactly in accordance with the recommendations. She followed the time and repetitions. She performed the exercises at home five times a day. Initially, it took twenty minutes, later thirty minutes and ended at forty minutes. The check-ups took place regularly every week.

Eliška's first reactions to the exercises weren't too obvious, but the muscle tone began to improve gradually. She slowly ceased to look like "a rag doll".

After six months of very intensive therapy, initial efforts to turn on the belly appeared and the interest in the surroundings began to grow. She resembled "Sleeping Beauty" slowly awakening from a deep sleep. Every tiny progress was recorded by Eliška's grandmother. She consulted the record and got sincere joy from it.

After the next two months, Eliška got on her knees and started to crawl on all fours. It took another two months, but Eliška began to stand up. At the time, she communicated pleasantly and was vividly interested in her surroundings. Walking appeared after more than ten months of very intensive exercise. Even after Eliška started to walk without aid, she still loved to hold the hand of her grandmother.

17.2.5
Explanation of the Solution

Therapy of infants older than six months usually involves more complications than the treatment initiated before the third month. This patient began therapy at the end of the ninth month.

The initial reflex responses to stimulation were small. The maximum frequency of implemented stimulation was selected at five times a day. One exercise took thirty-five to forty minutes. The goal of this extremely intensive stimulation was to lead the patient from the persistent overall muscle hypotonia and, concurrently, to prevent the development of the pathological substitute motor skills.

We think that this intensive therapy prevented the development of the pathology in terms of spasticity and the development of pathological dyskinesia too.

Strong and long-lasting hypotonia prevented the use of tilted surfaces and lability support. During the first six months, the developmental progress was only small, but gradually the patient started to be more concerned about her surroundings. Only after six months of therapy, the motor development began to accelerate remarkably. Gradually, crawling on all fours joined the turning and righting.

In the end of the twentieth month of age, the patient started to walk. Although the gait was unaided, balanced and matured, the patient wasn't willing to walk alone. She looked for a support and always held the hand of her grandmother. After another six months, this supposed separation anxiety ceased as the patient began to walk without aid.

The next check-up took place at eight years of age. She attended the second grade of elementary school and had full marks according to her grandmother. By second grade, she was playing the violin.

17.3 View of the Possibilities of the Restitution of Motor and Mental Functions in Infants with Severe Neurological Findings and Very Severe History in Terms of VM2G

We repeatedly found that it's important to initiate very intensive VM2G therapy in infant patients with severe signs of neurological impairment. If possible, the temporal and spatial summation of therapeutic stimulation should be combined. If we can't permit a choice of intensification of spatial summation because of muscle hypotonia, it would be necessary to push the temporal summation to the maximum. For this conception of therapeutic strategy, it is essential to have a cooperative home therapist, who would invest all his time into the therapeutic goal.

Logic dictates that the early initiation of therapy plays a very important role. Three months of age or less would be the optimal time. Nevertheless, the sooner the better holds true.

Intensive and long-term brain stimulation is most probably the only possible way to ensure neurogenesis, which was previously impaired. Impairment of normal development of brain tissue is followed by other gradual deterioration spread over time. It is due to apoptosis in particular. Neurons that didn't get the opportunity to interconnect with the neuronal networks are affected most. Because of inactivity or hypoactivity they succumb to pre-programmed death.

Preliminary utilisation of immature neurons participates in the overall deterioration of the neurological status. Due to insufficient differentiation, the neurons cannot fulfil the expected functional responses within the activity of neuronal networks and thus increase the overall chaos within the brain function.[28]

These impaired processes of maturation of the brain matrix constitute the fundaments of persistence of primitive new-born and infant reflexes. "Non-disconnection" of primitive reflexes results in an inability of onset of physiological developmental programs of righting and locomotion and gradual development of substitute pathological motor skills.

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28 KRAUS, Josef. Dětská mozková obrna. Praha: Grada 2005. ISBN 80-247-1018-8

Consequently, some form of cerebral palsy develops. Implementation of intensive VM2G stimulation permanently overwhelms the brain with activity because, after every stimulation exercise, the reflex activity continues in the brain centres for the following two hours. (Vojta, 1974).

Basic premise of reflex locmotion is:
An organ is developed by its function

17.3.1
VM2G is based on induction of a reflex that:

- Utilises ideal motor patterns, which are strictly individual
- Sets the degree of the load on muscles, joints and nerves exactly according to current bodily status, innate predispositions and biomechanical relations of the individual
- Absolutely excludes the probability of overload (muscular, neural, cardiopulmonary...).
- Prevents the reflex being "switched off" by any disease or trauma to the level of deep unconscious states.
- The program utilises permanent multifunctional feedback, so it enables the use of all available reserves of the musculoskeletal apparatus.

17.3.2
Reflex response or the "system" in the patient during the VM2G therapy is manifested in:

- Autonomic posture of the body and limbs against gravity without conscious effort.
- Gradual "deactivation" of the perceived body scheme to the level of a state before falling asleep.
- Realising the feeling of "losing the body".
- Autonomic joint centration manifested in shaking, shivering and movement automatisms, particularly of the hands, feet, whole limbs and pelvis
- Gradual extension of the time of the patient's tolerance of the stimulation without discomfort
- Increasing ability to tolerate the increase of load by multiple stimulation – balance discs, tilted and longitudinal position of the bed, tension of rubber straps, weights on the limbs
- Involvement of all muscles of the body in specific "mode" without fatigue during the performance of the therapy and afterwards
- There is no exhaustion within all stimulation zones; there is no tolerance of the stimulation
- The work of muscles reveals specific fatigue, usually localised due to muscle incoordination, which subsides immediately after cessation of the stimulation

Therapy of adults

bit.ly/2ollH1H

17.4
VM2G – Implementation in Children

It is irreplaceable in diseases of musculoskeletal apparatus from birth to about 3 years of age

- Motor and coordination disorders, peripheral and central neural lesions, e.g. facial palsy
- Postpartum brachial plexus palsy, Scoliosis of the new-borns, postpartum valgus pronation of ankle joints, meningocele
- Orthopaedic developmental disorders of the chest, spine, valgus knee, varus knee

In older children

- Peripheral palsies of the muscles, postoperative conditions after surgery of the musculoskeletal apparatus
- Central palsies in children
- Developmental disorders of the musculoskeletal apparatus – scoliosis

17.5
VM2G – Implementation in Adults

In neurology and neurosurgery:

- Neurodegenerative diseases (multiple sclerosis, myopathies, Parkinson disease)

Therapy of adults

bit.ly/2ou0LCQ

- Conditions after neurosurgical interventions (on spine, brain)
- Physiotherapy of conditions after stroke
- Physiotherapy of conditions after injuries of spine and peripheral nerves
- Functional disorders of the spine, functional myoskeletal disorders in general

Sports medicine:

- Conditions after sport injuries (ruptures of tendons and muscles...)
- Conditions after inflammations of myoskeletal system
- Conditions after overload of the musculoskeletal apparatus

Traumatology, surgery:

- Conditions after injuries of the musculoskeletal apparatus (following the acute phase)
- Combustions (following the acute phase)
- Multiple trauma (following the acute phase)

Orthopaedics:

- Developmental defects (spinal scoliosis, chest deformities, developmental disorders of bearing joints...)
- Degenerative joint diseases (arthritic changes of the joint cartilages, disorders of bearing joints...)
- Conditions after joint replacement surgeries
- Final treatment of traumatic conditions
- Conditions after orthopaedic surgical interventions

Anaesthesiology and resuscitation – coma:

- Intensive physiotherapy in patients after long-term unconsciousness

17.6 Case Study – Implementation of VM2G in a Patient with Chronic Progressive Pain of the Lumbar Spine

17.6.1 Illustration of the Problems with Chronic Spinal Pain

The patient, who sought help from our outpatient department, suffered from lower back pain. In the previous six months, the pain deteriorated so badly that the patient was unable to work. He was employed as a plumber, and his job required pronounced physical stress. MRI examination demonstrated herniations of intervertebral discs of three lumbar vertebrae. Previous rehabilitative and pharmacological therapy wasn't successful and the patient had been sent to the department of neurosurgery. The suggested surgical solution didn't seem suitable for him due to his physically demanding profession.

17.6.2 Description of the Problem (Clinical Findings)

Medical history and repeated X-ray and MRI findings proved the presence of herniations of intervertebral discs of varying severity at three levels of the lumbar region. These herniations pressed on the neural roots. The pain itself was typically distributed along the course of sciatic nerve bilaterally. The patient had significantly impaired statics and dynamics of the lumbar spine, which didn't develop when bending forward. Pain restricted the extent of the movements of the spine within all directions. The patient had a moderate degree of obesity that worsened the mobility of the body within the abdomen in particular. Obesity as an accompanying phenomenon worsened the possibilities of the restitution of movement. The patient was repeatedly reminded during expert consultations with the specialists that it would be necessary to reduce the weight to normalise the motion. The pain spread from the lumbar region to both legs down to the level of knees. Besides the permanent pain lasting for several months, paraesthesia in the dermatome innervated by the sciatic nerve appeared. A severe problem was indicated by intermittent motor loss, particularly after a longer walk – the tip of the right foot would not elevate sufficiently and the patient stumbled.

17.6.3 Expert Explanation of the Problem

Pain caused by functional and morphological insufficiencies of the spine is among the classic lifestyle diseases. The incidence increases together with the inability to work, leading even to disability. There are several factors contributing to these difficulties. Generally, they could be summarised under the term non-physiological "use" of musculoskeletal apparatus.

Obesity increases the risk of development of the functional spinal disorders, particularly in combination with a unilateral loading. When the pain becomes chronic, the reduction of weight is difficult to address. Restriction of caloric intake alone is not sufficient, unless it is accompanied by physical activity. Chronic spinal pain makes the implementation of sufficient physical activity impossible. Concurrently, obesity is the factor that participates in the back pain.

Herniations of the intervertebral discs, if located at multiple levels of the lumbar spine, press down on the root nerves and the spinal cord. Besides pain, restrictions to the sensitive

Disorder of the posture with thoracic hyperkinesis

Results after one year of therapy

nerves appear. This causes paraesthesia and occurrence of areas of decreased sensitivity at various locations on the legs. Compression of the motor component of the peripheral nerve constitutes a very serious problem, which is represented by loss of motor functions, mainly in the feet. This motor loss may impair the stereotypical gait and lead to stumbling caused by foot drop. Paresis of the perineal nerves is the final consequence. The effort to solve the change of impaired muscle coordination, the so-called lower crossed syndrome (refer to Janda, 1984) [29] by classical strengthening of the weak muscles and stretching of the shortened muscles doesn't have a positive effect in the long run. The effort to build a sufficient corset muscle by conscious action of the patient is limited by pain and obesity in the region of the abdominal wall. The patient comprehends the uncomfortable situation repeatedly explained by medical professionals, but he is not able to deal with it due to chronic back pain.

29 JANDA, Vladimír. Základy kliniky funkčních (nepatetických) hybných poruch. Praha: Ústav pro další vzdělávání stř. zdravot. pracovníků, 1984

17.6.4 Illustration of the Solution

The patient decided to undergo intensive VM2G physiotherapy. His wife became his home therapist. Thanks to the high level of motivation of the patient and his wife, it was possible to increase the therapy quickly. For home therapy, the patient bought a folding medical lounge, labilising disc, a set of stimulation balls, antiskid mat, mat under the disc and a set of weights on limbs.

Home exercises were performed twice a day for twenty minutes. Regular check-ups at the office attended by the patient and his wife were scheduled monthly. After each visit, it was possible to increase the load. It had been achieved by gradual increase in transversal and longitudinal tilt of the medical lounge, labilisation of supporting points and by increasing the load of weights on the hands and feet. Gradually, all limbs would be fitted with 2.5 kg weights. Implementation of the stimulation under these conditions was physically demanding, but only for the wife of the patient. The patient himself was in a relaxed state and the reflex itself, induced by stimulation, elevated the limbs with weights against gravity. The overall therapy took one year, although significant improvement was achieved after six months. Nevertheless, the stimulation and its intensification continued.

During the year, the patient has slightly reduced his weight. Now, he is fit to work, including carrying heavy loads, which is necessary for his job.

17.6.5 Explanation of the Solution

For patients suffering from chronic spinal problems, in which it is aetiologically apparent that the cause lies in both excessive strain and weight, it is very problematic to find a way of correction through classic therapeutic physical exercises. In cases where the functional disorder has shifted into gradual morphological change manifested in degeneration of intervertebral discs, moreover, with restrictions of root nerves and the spinal cord, the above-mentioned approach is usually hopeless. It can bring short-term relief from pain, but in most cases, it cannot start the process of recurring regeneration. The regeneration in patients with disc herniations is very difficult and it can't be restricted to strengthening or stretching of specific muscle groups. These targeted active exercises can have the opposite effect because it's the regulation of the essential "power unit" of the body that's been impaired.

Muscle chains that provide basic kinetic functions between the pelvis girdle on one side and the ribcage with shoulder girdles on the other are significantly inhibited in their functions in lumbar spine disorders. Their function is to perform the principal locomotion of the human body with the help of coordinated activity of muscle chains. These are sinusoid movements of the pelvis in relation to the chest secured by the coordinated interplay of flection and extension, lateral flection and outer and inner rotation.

In terms of biomechanics, the lumbar spine works as a three-dimensional cardan joint made of five levels. The bearing of these joints, the intervertebral discs, are able to carry a great load, but only provided that the force vectors of the load are in accordance with biomechanical parameters. These parameters need to be physiological.

First, the chronic overload leads to functional impairments and, subsequently, to structural disorders of the very construction of the discs. Clinical experience shows that the only meaningful intervention should involve the system of regulation, particularly, when the patient is obese.

VM2G allows gradual normalisation of the central regulating mechanisms responsible for the physiological coordination of the muscular chains. They are supposed to perform correct, centred and coordinated movements of the pelvis in relation to the chest. Gradual normalisation of this motion could return the deviated force vectors back to the physiological norm. Subsequently, the gradual slow reparative process can take place

Disorder of the body's
automatic posture,
results after two and three
years of therapy

in the skeleton, specifically in the intervertebral discs, but most probably in the vertebral bodies as well.

In our patient's case, we placed therapeutic weights on the limbs while facilitating the centring of their force vectors. Clinical experience gained over the previous 10 years has proved that it's prudent to not finish the therapeutic process in the phase when the pain has subsided. Particularly for patients who proved to have severe morphological changes and who experienced a large occupational or sporting strain on the locomotive apparatus, it is extremely important to proceed with the therapy for much longer. It's necessary to build sufficient resistance to upcoming physical stress. The experience showed that such an approach is extraordinarily effective and lets the patient tolerate physical stress without risk of recurrence.

17.6.6 View of the Solution of the Problems in Terms of VM2G in a Patient with Chronic Progressive Lumbar Spine Pain

Repeated experiences with patients who suffer from spinal problems have shown that the approach primarily focussed on the normalisation of the regulation of muscle coordination, represents the correct solution. It is effective in acute and chronic pain. The VM2G therapy also has beneficial effects not only in patients with problems caused by functional disorders, but also in patients with clearly demonstrated morphological changes of the spine.

Limitations associated with back pain such as obesity, reduced fitness in the elderly or psychiatric patients and other concurrent diseases don't represent an obstacle for VM2G therapy. The program of reflex locomotion is capable of solving many restrictions through intrinsic regulation and finding the optimal way to recurrent involvement of muscle coordination.

Therapeutic interventions themselves are successful and usually bring relief from pain very quickly. Sensitive regulation of the stimulation load allows the optimal initial therapeutic condition for "starting" the reflex to be set up. For patients in acute pain, the VM2G can be conducted under lighter conditions to minimise muscle strain and prevent painful irritation as well as to enable the reflex process itself. This leads to involvement of the coordinated activity of muscle chains and subsequently also to waning of painful neural irritation. The attenuation of pain persists even after the stimulation itself.

The gradual increase in intensity through stimulation with tilting of the medical lounge, labilisation of the supporting surfaces and adding weights to all limbs proved to be very useful. Weights on the limbs stimulate force muscle loops responsible for the transition of the forces between the pelvic girdle and the chest.

Thanks to labile supporting surfaces, the regulating system is being forced into intensive centration, particularly in the lumbar spine itself. In our opinion, a sufficient length of the therapy is extremely important, particularly in patients with chronic problems. It's the only way to ensure not only the cessation of the acute and chronic pains, but also to allow the reparative process in degenerated intervertebral discs to run its course and to ensure smooth locomotion and endurance of the musculoskeletal apparatus against strain.

17.6.7
Results of the VM2G therapy occur at several levels:

- Normalising the autonomic posture of the body at all levels from toes to posture of the head
- Normalising the setting of angles, axes and physiological extents in all joints of the body (influence of autonomic centration)
- Normalising the muscle tone and muscular coordination
- Normalising the autonomic regulation of righting reflexes
- Normalising the autonomic regulation of balancing reflexes
- Normalising the autonomic regulation of joint centration during physical activity without risk of recurrent decentrations, subluxations or blockages
- Normalising the basic stereotypical movements (gait, grip, respiration, swallowing…)
- Normalising the configuration of the body
    - Posture of the arches of the feet, posture of calcanei and toes
    - Axes of the lower limbs, particularly the posture of the knees and hip joints
    - Posture of the pelvis in all axes
    - Posture of the axes of the spine in sagittal and frontal planes
    - Configuration of the ribcage
    - Posture of the shoulder girdles, particularly of the scapulae
    - Axes of the upper limbs, particularly of the hand
    - Posture of the head
    - Posture of mandible
    - Position of the eyes and coordination of ocular movements

17.6.8
The therapy has a demonstrable positive influence on superior neural functions, including the cognitive functions.

- Normalising the palmar and plantar stereognosis
- Normalising the disorders of fine motor skills, writing, painting, playing musical instruments
- Normalising the reading, vocal presentation, singing
- Normalising the manifestations of hyperactivity in children with ADHD
- Normalising physical coordination disorders

17.6.9
VM2G can slow and delay pathological progression of manifestations of senile frailty, including the following:

- Tiredness during common daily activities
- Decreased mobility and restriction of physical activities
- Psychomotor slowing
- Deterioration of the physical condition
- Loss of muscular mass and power
- Instability with subsequent falls
- Uncoordinated motion
- Change in autonomic posture of the body, senile kyphosis of the spine and flexed posture of the limbs

17.7
Case Study, The Implementation of VM2G in Elderly Patients

17.7.1
Illustration of the Locomotion Problems in the Elderly

An eighty-four-year-old patient, who came to our office four years ago, had undergone total replacement of the right hip joint. At that time, it had been two years since the operation. The surgery was complicated because of inflammation. The joint had to be removed and repeatedly replaced once the inflammation was treated. This had shortened the limb and remarkably weakened the gluteal muscles. When walking, the patient experienced pain in the hip and the lumbar spine particularly. Due to the shortened limb, she had to use a walking stick.

Previous repeated rehabilitative and spa therapy focussed on active strengthening of the gluteal muscles and passive improvement of motion range in the hip joint hadn't achieved significant success.

17.7.2
Description of the Problem (Clinical Findings)

The medical history revealed other chronic diseases, particularly a treated tumour. A complication caused by an inflammation occurred during the hip joint replacement, resulting in the shortening of the limb by almost five centimetres, and significant hypotrophic to atrophic changes of the gluteal musculature. The atrophy of the muscles responsible for lateral stabilisation of the pelvis particularly complicated normal gait mechanism. Other skeletal muscles were in a very good condition. Bone density wasn't remarkably osteoporotic. Basic stereotypical gait was impaired by incipient pain and the muscle hypothrophy on the whole right side of the pelvis. Gluteal muscles didn't enable posterior and lateral extension of the lower limb. The gait of the patient was noticeably swaying to the right side. The patient regarded her walking as exhausting, painful and limiting in many activities. She looked for a way to regain her former good shape.

17.7.3
Expert Explanation of the Problem

If a challenging surgical intervention, which causes devastating consequences to large muscle groups, wasn't followed by adequately sufficient and focused rehabilitation, gradual hypotrophy or atrophy of the involved muscles would appear. This process may spread to adjacent muscles that haven't been operated on, and the resulting state is far severer, particularly in terms of morphology and function.

The purpose-built links within muscular chains become impaired, which further impairs the regulation of muscle coordination. As result of insufficient and late rehabilitation, the formerly peripheral disorder influences central regulatory mechanisms.

The muscles have been devastated and subsequently become atrophic because of the insufficient stimulation. Consequently, these processes lead to their partial alienation in the CNS. The process of alienation that generally works as a protective mechanism during the phase of posttraumatic reaction should be disconnected again in the reparative phase to let the muscles return to their normal function again.

If the muscles weren't sufficiently stimulated, the phase of alienation would be prolonged and would have an ominous influence on future muscle function. That's why it's important to involve the muscle stimulation as soon as possible. Its omission in elderly patients has more serious consequences than in younger patients as it could become the source of deteriorated locomotion. Subsequently, the impairment of physical condition leads to senile frailty and an increase in the risk of falls with all the harmful consequences.

17.7.4
Illustration of the Solution

The patient tolerated the VM2G therapeutic stimulation very well. Since the patient lives in Great Britain, we agreed on two check-up visits at an outpatient office and consultations via Skype.

Her home therapist was well trained and the course of therapy ran smoothly. Gradual intensification of stimulation was very slow.

Special training clothes with integrated vibrating stimulation balls proved to be a useful aid. Inducing the reflex stimulation was quite simple with its help. The therapeutic dress was also beneficial for the patient in terms of tolerating the therapy.

The gait and stability in standing gradually improved. The overall status didn't diminish, physical and mental freshness and the working performance remained in good condition. Two years ago, the patient had a break in training for three months because of a change in home therapists. She described her overall condition as beginning to deteriorate. Renewed commencement of the exercise has brought her back to her former condition. Now, the patient has decided to continue the VM2G therapy permanently.

17.7.5
Explanation of the Solution

Implementation of active rehabilitative exercises in elderly patients is complicated. The restriction results from the reduced overall physical condition, often accompanied by several internal diseases and weakening of the cardiovascular system in particular. Among the elderly, physical activity and effort to perform individual exercises is often made more difficult by scant motivation. Therapeutic physical exercises may be accompanied by subsequent general fatigue and aches of muscles and joints. That is why the systematic rehabilitation is problematic in this group of patients.

Experience with rehabilitation shows that classic active movement therapy is not tolerated well among the elderly, and only with great effort. Elderly patients usually come with several polyvalent difficulties, most often muscular pain and rigidity, overall fatigue and hypomobility.

17.7.6
The View of the Therapy of Locomotive Problems in Elderly and the Solution in Terms of VM2G

The available technique of stimulation of the locomotive apparatus with VM2G, during which the patients are in a relaxed state and predominantly for the elderly in the supine position, is usually received very well. VM2G respects the actual mental status and physical exhaustion. Gradual and sensitively increased intensity of the stimulation is well tolerated by the elderly, as it doesn't induce any negative reactions in terms of fatigue or pain. After stimulation, the patients usually feel relaxed. If they had pain before the stimulation, it would usually diminish or even cease afterwards. This could be explained by improvement in the autonomic regulation of the posture of the body and the normalising of the stereotypical gait and breathing thanks to VM2G therapy, which are usually impaired in the elderly. This naturally influences several other bodily functions – improvement of venous return from the lower limbs, resolution of the swellings of the lower limbs, facilitation of the activity of the right side of the heart, general improvement in action of the cardiopulmonary system, oxygenation and thus brain function, improvement in the function of the digestive apparatus etc.

In terms of VM2G physiotherapy, there is no contraindication in exhaustion of the patients with chronic pain or in patients in subacute state. These conditions are often accompanied by a depressive mood. Patients with psychiatric disorders are difficult to persuade into active physical activity. Our experience shows that the available form of VM2G therapy is well accepted under these circumstances and the patients perceive improvement in their mental state after therapy. It seems that the Vojta method of the 2nd generation could positively involve the treatment of the elderly in a significant way.

17.7.7
VM2G can have the following impact on the lives of seniors:

- Tiredness during common daily activities
- Decreased mobility and restriction of physical activities
- Impairment of basic stereotypical movements (gait, grip, breathing, swallowing)
- Psychomotor slowing
- Deterioration of physical condition
- Loss of muscular mass and power
- Decreasing tolerance of physical exertion
- Instability with subsequent falls
- Uncoordinated motion
- Change in autonomic posture of the body
- Sensory and especially sensorimotor deficits
- Chronic pain

17.7.8
VM2G – Basic Prerequisites for Performing the Therapy

Basic knowledge of developmental kinesiology

- Physiological
- Pathological

Basic knowledge of positions of reflexive stimulation

- Reflexive turning 1
- Reflexive turning 2
- Reflexive belly-crawling
- Reflexive crawling on all fours

Other knowledge

- Movement interplay enabling the transition from one position of the body to another
- Basic knowledge of the righting mechanisms
- Knowledge of the system of stimulation zones and their utilisation
- Combinations of stimulation zones (spatial summation)
- Induced by vectors of movement of the limbs and the torso

Broadening and superstructural possibilities of VM2G

- System of inhibition of the induced movement
  - Counter-movement with rubber straps
  - Restraints
- Stimulation by balance technique, Aktiva disc, inflatable balls...
  - Stimulation by changing the position of the body by tilting the medical lounge, in longitudinal and transversal axis
  - Stimulation by shifting the centre of gravity of the limbs with the weight
  - Auxiliary techniques, support of limbs, antalgic positions

18. The Performance of the Therapy Itself

18.1
Basic Initial Conditions and Positions for Inducing the Reflexes

- On the back – reflexive turning 1
- On the side – reflexive turning 2
- On the stomach – reflexive crawling
- On all fours – reflexive crawling on all fours
- Basic stimulation of reflex zones, placement and directions of the stimulation
- Basic inhibition of the induced movement

18.2
Extension Positions and Therapeutic Accessories Facilitating the Course of the Reflex

- Gradual multiple stimulation of reflexive zones
- Partial labilisation of pelvis by Activa disc, wedge underlay of the pelvis with Activa disc
- Gradual longitudinal tilt of the bed, body lies on the adhesive pad (head goes higher than feet)
- Complete labilisation of pelvis by Activa disc by underlying the chest
- Tilting of the pelvic axis in the transversal direction with a wedge
- Tilting of the axis of the body in transversal direction
- Labilisation of other supporting points with inflatable balls
- Inhibition of the movement of the limbs with rubber straps
- Inhibition of the movement of the limbs with restraints
- Shift of the centre of gravity of the limbs with weights

18.3
Supporting Positions and the Equipment Facilitating the Induction of the Reflex

- Tilt of the medical lounge along longitudinal axis, with head slightly tilted down
- Placing supports under the feet
- Placing supports under the hands
- Placing supports under the pelvis with solid wedge
- Antalgic positions of the limbs and the axial organ

18.4
External Conditions of Stimulation for VM2G

- A quiet and peaceful environment, so patients are not disturbed
- Technical equipment, appropriate aids
- The ability to track time of individual stimulation and the overall stimulation

Severe developmental disorder of the posture of the body, initial scoliotic deviation of the spine, inverted sternum, funnel-shaped chest deformity and the forward pull of the head; 9 years of age.

Normalising of the curved spine, position of the sternum and the shape of the chest; posture of the head has improved significantly; the Vojta method has been implemented for 4 years; 13 years of age.

18.4.1
Education of the patients in VM2G

- To introduce the patient into a relaxed state
- To explain to him that it's not necessary to hold the position, the reflex itself is going to "hold" in limbs in set positions against gravity,
- To explain that the perception of body's scheme is going to be "switched off" gradually, and they will stop to feel where their limbs are located,
- To explain, that they will experience gradual manifestations of "autonomic joint centration", i.e. the shiver, tremor and involuntary movement of the limbs and pelvis.
- Encourage the patient to report any discomfort (pain, tension in muscles, onset fatigue) that may arise
- To explain to the children not to "play" with the ongoing reflex and not to disturb it; distract them with singing, music, audio books, etc.
- Necessary diversion of the attention in children (singing, music, audio books…)

18.4.2
Observing the Reactions Induced by VM2G Stimulation in the Patients

- Autonomy of the posture of the limbs against gravity
- Setting the angles of axes of the limbs and their changes
- Intensity of the reflexive movements, shivering, tremor
- The speed of the onset of fatigue
- Whether the stimulation does not cause pathological substitute posture of the limbs
- Duration of the uninterrupted stimulation, breaks, overall duration of therapy

18.4.3
Repeating the Therapy within One Day

- In children preferably 2 to 3 times a day
- In adults with respect to their possibilities at least once a day

18.4.4
Management of the VM2G Therapy Takes Place:

- According to actual intensity of the "system" response (tremor, size of movements…)
- According to patient's individual responses (speed of onset of fatigue, pain, discomfort)
- According to changes in the autonomic regulation of posture of the body
- According to changes in autonomic regulation of joint centration
- According to changes in basic stereotypical movements
- According to changes in "extension" programs of soft and gross motor skills
- According to changes in regulation of superior nervous functions, improvement of phatic functions, abatement of dyspraxia, onset of fatigue, irritability

18.4.5
Reflexive Response of "the System" of the Patient in VM2G Therapy

- Autonomic posture of the body and limbs against gravity with no voluntary effort
- Gradual "switching off" of perception of the body scheme up to the level preceding falling asleep, the perception of the feeling of "loss of the body"

Video – therapy of children and adolescents

bit.ly/2npP0vx

bit.ly/2nKEJ0d

- Autonomic joint centration manifested with tremor, shiver and movement automatisms, particularly in hands, feet, whole limbs and pelvis.
- Gradual prolonging of the time of the patient's tolerance of the stimulation without discomfort
- Increasing ability to tolerate the increase of strain through multiple stimulations, balance discs, tilted and longitudinal position of the medical lounger, tension of rubber straps, weights on the limbs
- Involvement of all muscles of the body in specific "mode" without fatigue during the performance of the therapy and afterwards
- There is no exhaustion within all stimulation zones; there is no adaptation to the stimulation
- The work of the muscles reveals specific fatigue, usually localised, caused by lack of muscle coordination, which subsides immediately after cessation of the stimulation

18.5 Case Study

18.5.1 Illustration of Implementation of Tilted Medical Loungers and Labilising Discs

A seven-year old patient was admitted to our care due to milder disorder of the posture of the body. The patient's mother worried about the future development of the locomotive apparatus of her daughter because chronic back pain had been apparent in the family for several generations; the mother herself had such problems, too. The patient admitted that she also experienced back pain sometimes but couldn't localise it specifically. The patient didn't have any other problems.

18.5.2 Description of the Problem (Clinical Findings)

The history of the patient didn't reveal any remarkable deviations from the normal psychomotor development. She started to walk at the end of the first year of life. The examination of the basic stereotypical movements was essentially normal. The only problem determined was weak diaphragmatic breathing. Autonomic regulation of the standing and the general axis of the body involved the deviations from the norm in the forward pull of the whole body in the ventral direction. Basic sagittal axis originating from the centre of the outer ankle joint didn't come through the expected physiological points. In standing, there was apparent greater stress on the tips of feet than the heels. There was ventral tilt of the pelvis and ventral rotation of both shoulder girdles. The pelvis was tilted ventrally and the shoulder girdles were protracted. Her head was pulled forward, so it didn't align with the axis.

18.5.3 Expert Explanation of the Problem

The origin of the disorder of the autonomic regulation of the posture of the body could most probably be caused by hereditary predisposition. The mother confirmed that the posture of her daughter was similar to her adolescent posture. During the first year of age, the patient could have experience a mild form of central coordination disorder, which would have contributed to impairment of the regulation of the motor skills. The relevant misalignment could be observed in the ventral tilt of the pelvis and the ventral posture of both shoulder girdles. Because of the family predispositions to chronic problems with the locomotive apparatus, the effort of the mother to seek a solution for her daughter to prevent eventual future problem, i.e. spinal problems, could be considered very prudent.

18.5.4 Illustration of the Solution

Although the problem with the posture of the body in this patient had seemed to be quite simple to solve, its correction took six years. The patient's mother was highly motivated to help her daughter and so the therapy was carried out very carefully. The frequency of visits was set to once every four weeks. Improvement in the posture of the head, pelvis and shoulders began to be successful, especially thanks to the exercises on the tilted surface of the medical lounge. The longitudinal tilt of the medical lounge was technically provided by the adjustable setting of the lounger legs. The transverse tilt was secured by implementation of the training underlay. The balance discs and labilising restraints comprised the other aids that accelerated the improvement in posture of the body. The patient didn't complain about back pain during the therapy.

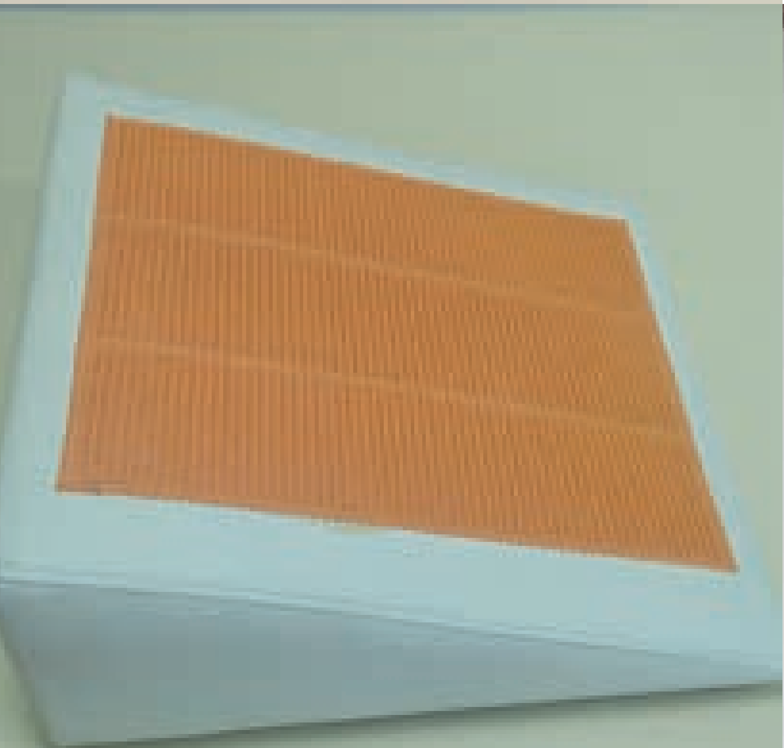
18.5.5 Explanation of the Solution

The chosen therapeutic method of labilising the supporting points during the reflex exercises significantly helped to provoke the repair program of the regulation of the body. It was necessary to target the stimulation more on the involvement of the anteroposterior muscle chains than the oblique chains. Although it might seem that the curing effect hadn't come for several months and the changes towards a normal state progressed very slowly, the direction of the therapy proved to be correct. Normalising changes were fully ossified within the following development and the final effect of the therapy brought very good results. It's interesting that VM2G successfully intervened also in this case of assumed hereditary preconditions of the patient's problems.

18.5.6 View of the Solution of the Problems with Autonomic Regulation of the Posture of the Body with the Help of Labilising Restraints and Tilted Training Surfaces

The exercise equipment on the tilted longitudinal surface in combination with tilted transverse surface significantly improved the correct therapeutic targeting. Combining both angles creates the conditions for activation of the torsion biomechanism of the body, whose direct muscular chains head through its imaginary centre. These torsion conditions were concurrently used to labilise the supporting points of the body. By joining the difficult initial spatial and adhesive preconditions, the induction and maintenance of the stimulation reflex become extremely challenging for the brain. Thanks to this, the therapeutic reflex runs extremely precisely and could be perceived in a specific part of the body. Implementation of this kind of therapy puts special demands on the physiotherapist because he has to manage to create the optimal extent of the load and explain the implementation of the stimulation as part of home exercise correctly. The optimal extent of the load is based on the current ongoing reflex response in the patient and on the actual dispositions of the patient.


MA&TY
2 kg



19. Technical and Technological Instruments for Application of VM2G

19.1
Three types of mats for supporting the cervical spine

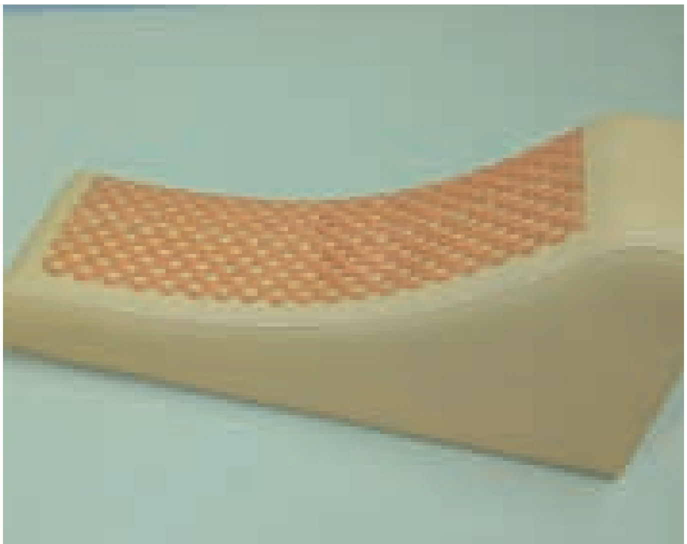
It is extremely important to provide the patient with the best conditions possible during VM2G therapy. The mats of various thicknesses have proven to be beneficial for positioning the head on the back and on the side to prevent the head from being in reclination or lateral flection. Adequate firmness and elasticity of the mat is also important.

19.2
Two types of inflatable Activa-Discs

To simultaneously position and labilise the pelvis, the implementation of firm and elastic discs has proven beneficial. When laid under a patient's pelvis, arm or leg in position on the back, side or stomach, they can achieve both facilitation of the reflex activation (supporting the flection of the pelvis in the supine position) and labilising the supporting points, i.e. intensifying the course of the reflex significantly.

19.3
Two types of supporting mats for supporting the arm

Supporting mats for supporting the arm enable the support of the occipital limb in the supine position of a patient. It prevents the hyperextension of the arm with subsequent pain in the shoulder joint. It simultaneously allows the patient to support the occipital arm safely and comfortably in the physiological position. The mat allows the patient to pull him/herself into oblique and torsional positions. The two sizes of the mats have proven to be beneficial in children and adult patients.



19.4
Fig. Various types of elastic bandages

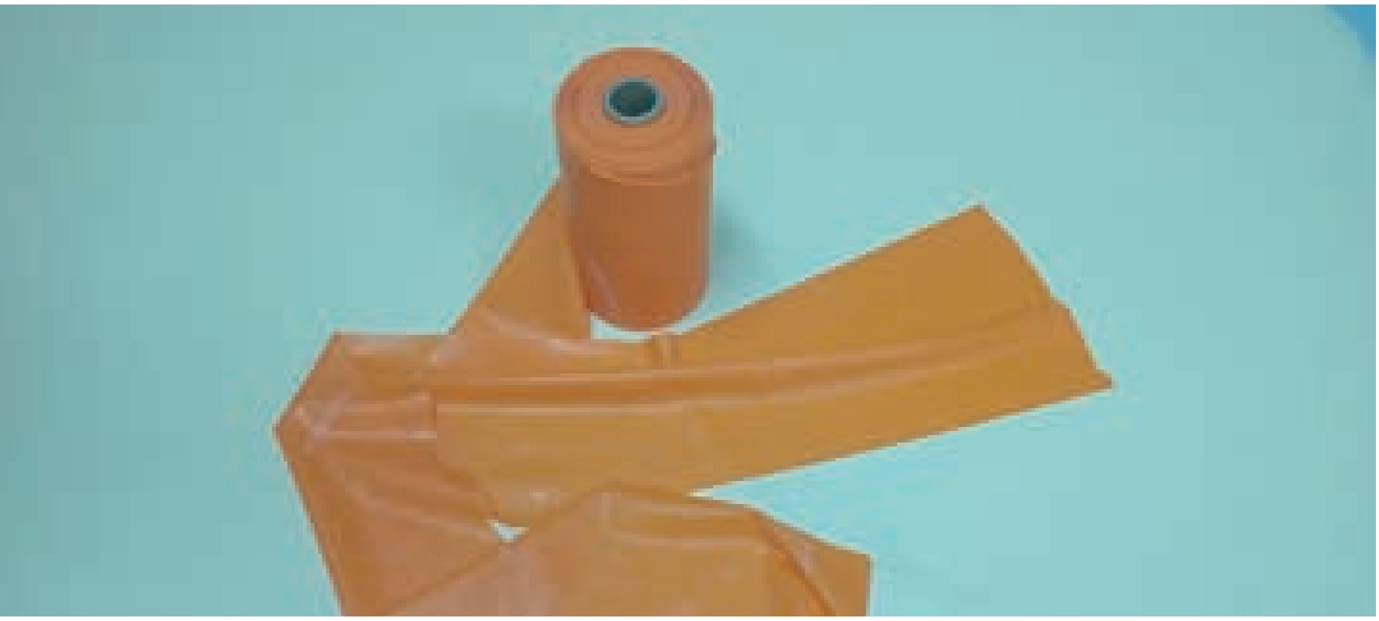
Elastic hose bandages of various widths are beneficial for affixing stimulating balls to the patient's body. According to the width of the torso and the limbs, width of the bandage can be selected from three centimetres (e.g. for infants' limbs) to twelve-centimetre wide bandages for the chests of adult patients. The bandages are elastic enough to provide the reflex stimulation in active zones.

19.5
Anti-skid mats

Anti-skid mats have proven to be highly beneficial during the therapy of the infants, older children and adult patients. They prevent the undesirable slipping movements of the body and the limbs supported by the mat during reflex stimulation. They improve adhesion of the supporting points significantly and thus increase the effect of the reflex. Anti-skid mats are used at the same time in the therapy of infants to prevent excessive movements of the limbs.

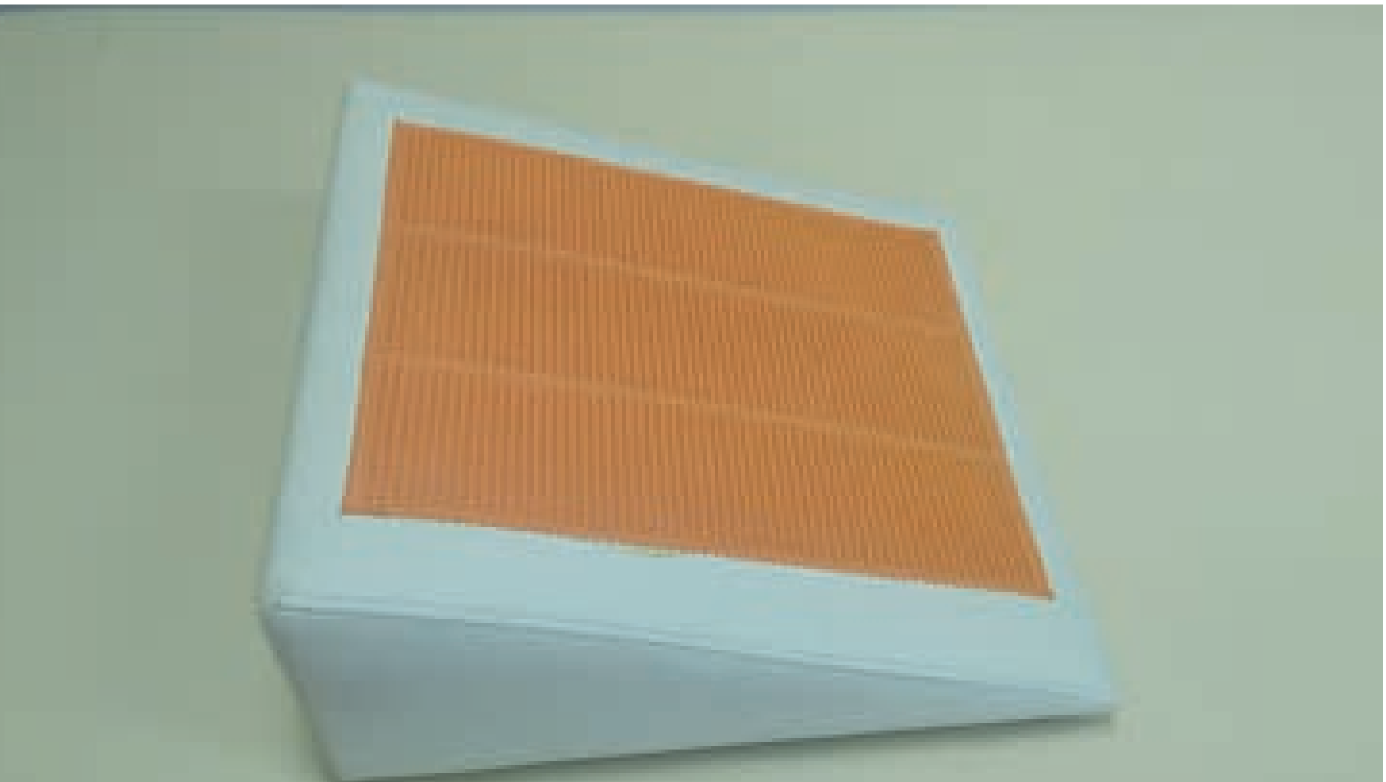
19.6
Fig. Elastic exercise bands

Elastic exercise bands are used as aids in VM2G therapy to temper the reflex movements of the limbs. It enables the forming of supporting points of the limbs that are elastic and at the same time unstable. Thus, it facilitates the reflex stimulation.

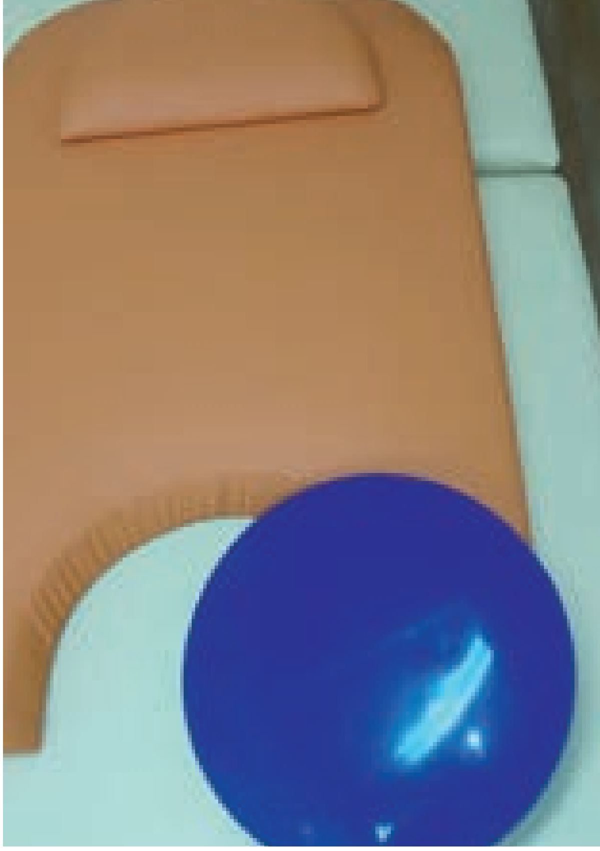


19.7
Wedged underlay

A wedged underlay is suitable for facilitation of the reflex stimulation predominantly in patients with impaired function of the lumbar spine. Underlaying the pelvis with the wedge eliminates the pain in this spinal region. The wedge could be used to support the ribcage in oblique and torsional exercising positions.



19.8
Mat with space for a disc



A mat with space for a disc has proven to be beneficial for gradual increase in intensity of reflex stimulation, particularly in the supine position. It allows the head, the ribcage and the pelvis to be straightened in one plane, but the pelvis could be underlaid with a disc. It results in stable support at the side of the head and the ribcage, while the pelvic side is completely labilised. Moving the disc to the sidewalls of the space provides oblique support of the pelvis, which at the same time represents labile surface. The mat allows the performance of reflex stimulation under longitudinal and transverse tilt of the medical lounge. It also simultaneously influences the torsional mechanism of the muscular loops of the body.

19.9
Therapeutic dress for VM2G reflex stimulation

Implementation of this dress is beneficial in patients of all ages, particularly in those, who need to be provided with intensive stimulation (e.g. infants at risk of a high degree of central coordination disorder or patients after spinal cord lesions and other severe conditions). It is also useful in cases, where the implementation of the stimulation by a home therapist is problematic. The dress provides activation of at least twenty-two active points. Mechanical stimulation through pressure provided by elastic balls is complemented by the stimulation with micro-vibrations. The intensity of the vibratory stimulation could be comfortably regulated through electronic means.

Therapy in stimulating dress

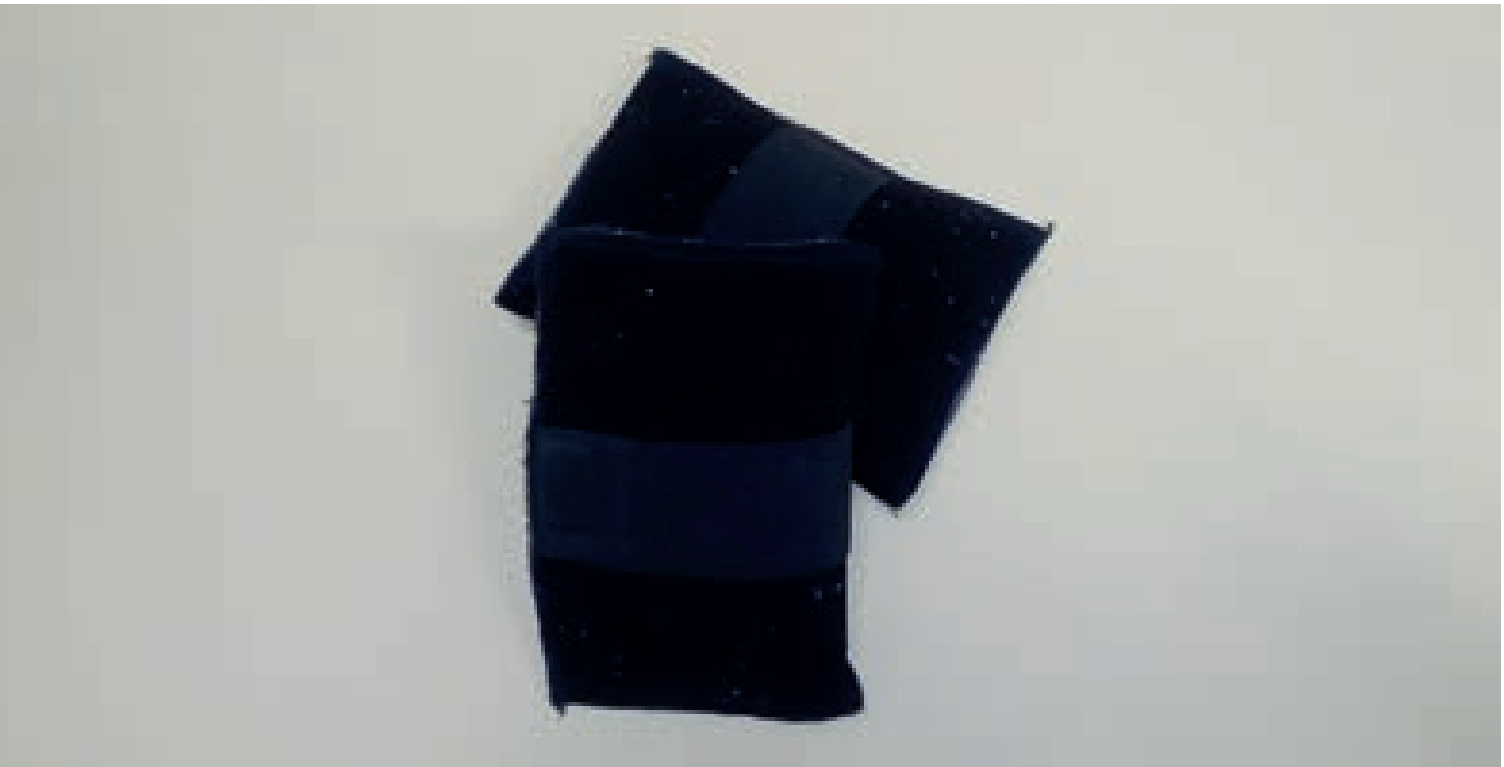
bit.ly/2mXL9KO

19.10
Elastic stimulating balls

Elastic balls of various sizes and degrees of hardness are used for reflex stimulation within VM2G. Stimulation with balls is very well tolerated and offers higher comfort to the therapists. Thanks to the stimulating balls, concurrent activation of several reflex zones is possible.

19.11
Small weights for infants and preschool children

Use of 125 g and 250 g weights has been beneficial within the therapy of the infants and the preschool children. Their utilisation increases the reflex stimulation by shifting the centre of gravity of the limbs. They could easily be attached with an elastic band or Velcro.



19.12

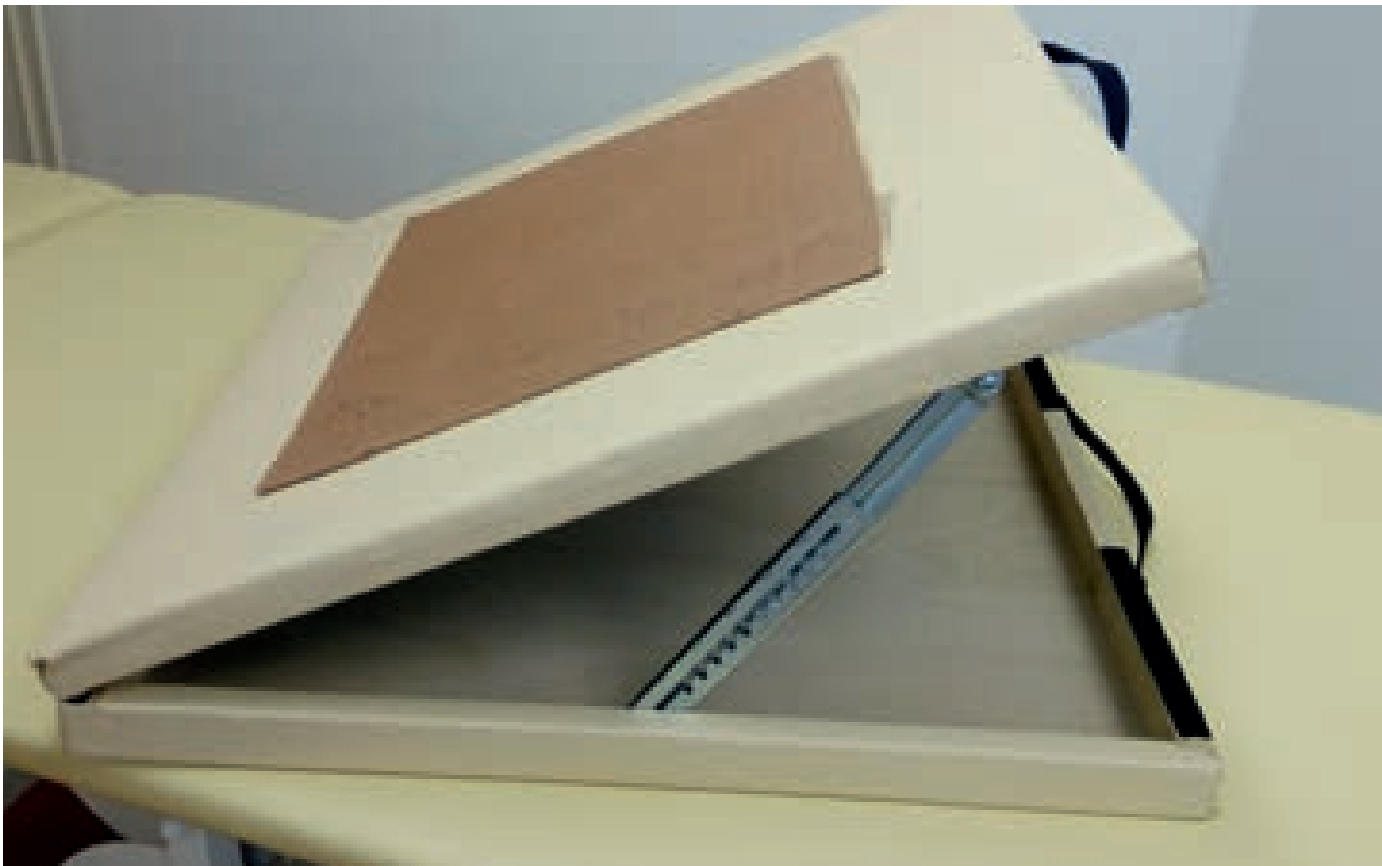
Large weights for school children, adolescents and adult patients

0.5 kg, 1 kg, 1.5 kg and 2 kg weights are used. Their utilisation increases the reflex stimulation by shifting the centre of gravity of the limbs. They could easily be attached with an elastic band or Velcro.

19.13

Adjustable medical lounger for children

An adjustable medical lounge for children is used within the therapy of infants and preschool children. It enables comfortable and continuous elevation of the tilt of the surface of the medical lounge. The surface of the medical lounge is highly adhesive and provides safe positioning of the child without risk of the body sliding on the tilted surface.



19.14
Over ball

Very soft inflatable balls have proven to be beneficial for the labilising of the supporting points of the torso and the limbs during the VM2G therapy. Variable inflation intensity changes the hardness and the way the points are exposed to lability.

19.15
Special stimulating balls for the therapy of new-borns and infants

Stimulating balls made of pliable foam rubber are used in therapy of very small children. Their main features are high adhesiveness and softness. These balls are also used in older patients with low perception threshold and for stimulation of orofacial zones.

19.16
Case Study – Illustration of the Problems with Soft and Gross Motor Skills and Superior Nervous Functions

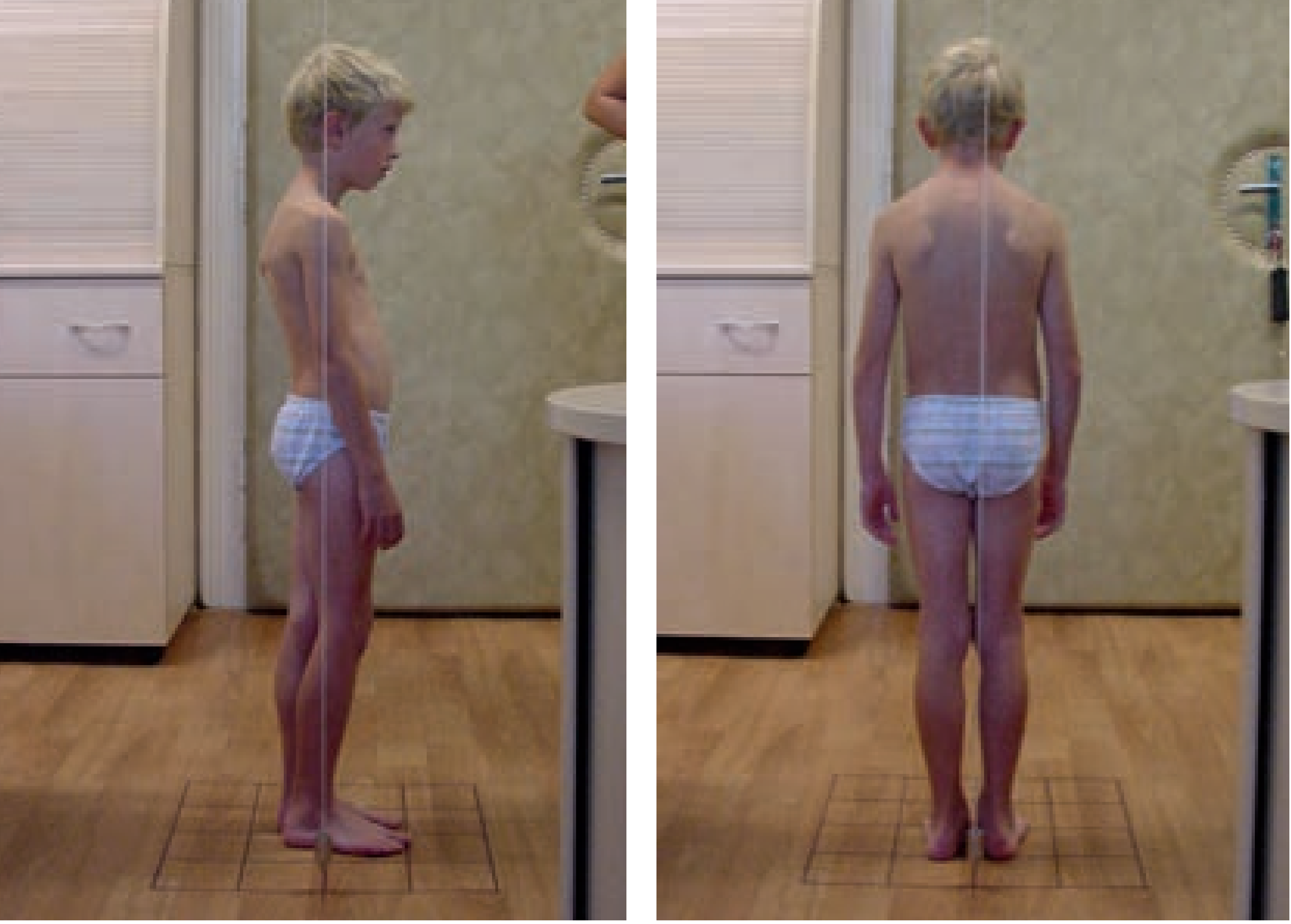
A nine-year-old patient was placed in our care because of a disorder of the fine motor skills. His mother described her son as extraordinarily clumsy. He wrote and drew incorrectly, had problems making things from modelling clay and building with children's blocks. She noticed these difficulties during his preschool age. In that time, he grew poorly, he was generally clumsy and he couldn't tie his shoes. At school, his problems became more apparent. He was very clumsy during physical exercises and often ran into objects as if he couldn't guess the right width of the doorframe. He slept with an open mouth and snored. His mouth was opened in his conscious state when he was focusing on something. He didn't undergo any rehabilitative care in childhood or later. He attended Educational and Psychological Counselling for specific disorders, namely dysgraphia and dyslexia. The school results were rather under average, although according to the tests, his intelligence was slightly above average.

19.16.1
Description of the Problem (Clinical Findings)

The medical history revealed a problem during the delivery. It was prolonged and the subsequent adaptation wasn't optimal. Development during the first year of life was delayed. He started to walk without assistance at about two years of age. The patient had clearly visible dyspraxia during dressing and undressing. He showed problems with lateralisation while standing and in the supine position. Standing on one foot was too complicated and unstable for him. When standing, there was an obvious severe disorder of autonomic regulation of the posture of the body. There were misalignments of the pelvis, the chest and shoulder girdles. His head was pulled forward; his mandible ran backwards, and his mouth was slightly opened. The abdominal wall was relaxed while standing. In resting supine position, the lumbar spine was still bent into hyperlordosis and didn't touch the surface. There was an apparent rotation of toes of both feet inwards, more pronounced on the right side. A slight ulnar deviation was also apparent on the right hand in this position. He couldn't breathe into the abdomen while standing or lying in the supine position. He turned the toes of his feet inwards while walking, more on the right foot. He hadn't been recommended the care of the physiotherapist yet.

19.16.2
Expert Explanation of the Problem

Aetiologically, we can track down the disorder of the autonomic regulation of the posture of the body, impairment of the gross and soft motor skills and the impairment of the basic stereotypical movements up to the period of the development of the programs regulating this fundamental locomotion. Kinesiological development of the first year was prolonged and, subsequently, had "wrapped up" several substitute movement mechanisms. These imperfections were apparent both in autonomic regulation of the posture of the body, basic stereotypical movements of gait, grip, breathing and in gross and fine motor skills. Whole lower limbs showed obvious inward rotatory posture, most pronounced in the acral parts of the limbs. The impairment of the posture of the lower limbs and impaired



Disorder of the body's automatic posture, condition in 2011

stereotypical gait resulted in inward rotation of the toes when walking. While running, the patient stumbled over the toes. The pelvis stood in remarkable anterior flection. Consequently, there was impaired coordination of the superior nervous activity especially manifested in dyspraxia and impairment of fine motor skills – impaired graphic motor skills specifically, aggravated by the ulnar deviation of the hand. Disturbed coordination of the gross motor skills was most visible in the pursuit of equilibristic performances like standing on one foot or standing on the toes. The disorder of the anterior posture of the head was accompanied by retrogenia resulting in incorrect dental occlusion and impairment of the stereotypical movement of the whole orofacial region. It was highly probable in this patient that without adequate therapy, there was the remarkable risk of deepening and fixing of the above-mentioned disorders of the locomotive apparatus, including possible development of spinal scoliosis and chest deformity. The disorder of regulation of the posture and stereotypical movements in the orofacial region resulted in impaired development of teeth in terms of crookedness and irregularity. Because of the rather difficult dental care, the teeth were prone to carious lesions and the development of gingivitis. Occlusion defects cause problems with chewing and deteriorate articulation.

Disorder of the body's automatic posture, condition in 2014

19.16.3 Illustration of the Solution

For four and half years, the patient and his mother have attended our outpatient department monthly. We can gradually increase the load very slowly.

For a long time, we couldn't create a stable regulation of the position, but recently, it's been possible to perform the exercises on the tilted table, balance underlays and gradually increase load. Overall posture of the body has gradually improved, the anterior pulling of the head subsided and the posture of the mandible also normalised completely. The patient has learnt new abilities requiring good balance like riding a bike, skiing and skating.

Dyspraxia improved remarkably, especially during the common daily activities, and the ability to perform accurate and measured movements normalised. Reading normalised, including reading aloud. Slight opening of the mouth during sleep vanished and in the conscious and focused state. The gait has become regular and coordinated. The toes have been placed in the normal slightly outward rotated position. Ulnar deviation of the right hand subsided and the grip normalised. The posture of the pelvis, ribcage and shoulder girdles significantly improved. The stereotypical breathing normalised and the overall physical condition of the patient as well. While the complete ideal normal posture and motor skills haven't been achieved yet, the patient stays in our care. VM2G has proved to

Disorder of the body's automatic posture, condition in 2016

be highly effective on the motor skill problems and also, on the above-mentioned problems that are closely related to motor skills and significantly influence the life of the patient. Costs reimbursed from the health insurance include the monthly rehabilitation.

19.16.4 Explanation of the Solution

Correction of the complex disorder in quite complex condition of the patient would be manageable, if the system of basic autonomic regulation of the posture of the body and the basic stereotypical movements were involved. Concurrently, the therapy has been targeted on the correction of the regulation of the coordination of fine motor skills of the hand and the orofacial region. Also in this case, developmental phases could be used, i.e. the potential provided by the growth of the locomotive apparatus.

Normalised posture of the spine also led to concurrent normalising of the posture of the shoulder girdles in the frontal and sagittal axis. Configuration of the chest also normalised, as well as the posture of the head and mandible. Function of the stereotypical breathing normalised too. Despite the initially complicated status, the condition of the patient has been returning to normal function in terms of motor skills, superior nervous functions and morphology of the locomotive apparatus. According to the previous course of therapy itself and the cooperation of the family we can make the excellent prognosis of the overall upcoming development of the patient.

19.16.5
The View of the Role and Solution of the Problem with Fine and Gross Motor Skills and Superior Nervous Functions (SNF)

In terms of the actions of SNF, it's necessary to take the periods of development of basic motor programs into account. Impaired regulation of the programs responsible for control of the locomotive apparatus often manifest in programs responsible for the regulation of SNF. This interconnection is most apparent in children with flagrant disturbances of motor programs, i.e. the children with diagnosed cerebral palsy. The manifestations of impaired SNF have been well described in them and the approach must take them into account, including education. Such intensive care hasn't been practiced yet in children with motor clumsiness, dyspraxia and specific learning disorders. Originally called motor development disorder, it originated in the first year of life and gradually established itself in other regions of the brain and disturbed several functions and common daily activities. Concurrently, it restricted complex development of the patient's personality and made harder his education, speech abilities, development of sports activities and the possibilities to learn to play the musical instruments or sing. The former central coordination disorder led to impairment of the regulation the balance and the regulation of the interplay of straight and oblique muscle chains. This disorder was further manifested in impairment of bone growth and subsequent development of deviations of bone and joint axes, basically of the whole skeleton. The developed disorder of regulation of the muscle chains resulted in a defect in the regulation of the diaphragmatic function. The impairment of the coordination of the stereotypical breathing developed along with the disturbance of the regulation of the muscle tone of the chest musculature. This subsequently resulted in gradual collapse of the sternum and the impairment of the configuration of the chest. Another interlinking of the disorder was apparent in the impairment of the posture of the head in terms of anterior pulling. This disturbed posture of the head appeared in developed retrogenia and concurrent disorder of orofacial coordination.

Therapeutic intervention by VM2G involves both normalising of programs responsible for the regulation of motor skills, and the programs controlling the SNF.

It can be observed that the following growth of the locomotive apparatus has happened under the formative influence of normalised programs. The goal is to achieve normalising of the locomotive apparatus completely, of the autonomic regulation of the posture of the body including its basic stereotypical movement as well as the normalising and development of the potential of SNF.


Maturant 2015

20. My Daughter's Story – Case Study on Morphological Changes of the Hip Joint Influenced by VM2G Therapy

"When a phenomenon is heretofore inexplicable, if it really exists, then there's no reason to deny it. If the phenomenon exists, what's the point in denying it? They must be studied, not denied."
"The absence of evidence is not evidence of absence."
Carl Sagan, Astronomer

At four years of age, a severe developmental disorder of the right hip joint appeared in our youngest daughter Kateřina. It manifested in acute pain during her first attempts to ski. She gradually stopped walking because of the pain, and her right leg was visibly shorter than the left one. An X-ray image confirmed the diagnosis of Perthes disease (morbus Perthes), which is classified among the most severe and most common avascular bone necroses.

The necrosis that develops within the bone is caused by impaired blood supply to the upper head of the femur. The centre of the bone, which is supposed to ossify, dies (undergoes necrosis) and is re-built by living bone tissue. As you may have guessed, this bone is of a worse quality than the one that would have been formed originally. Thus, it leads to premature deformities in the joint and to arthrosis and more frequent fractures. It usually occurs in boys from 3 to 8 years of age. It is bilateral in about 10 % of cases. The causes of the low bone blood supply haven't been identified yet, but ongoing research indicates that the disorder of blood clotting could be the cause.

The diagnosis is based on an X-ray or MRI that shows dilation of the joint space and irregularities within the joint structure.

There is a conservative therapy based on the disengagement of the limb to reduce the muscle tension, or there are surgical treatment options. After surgery, walking with the exclusion of sports activities is permitted for the next three months. [1]

Traction therapy with an Atlanta splint aimed to remove the contracture (see photo) is among the other options of conservative treatment.

At five years of age, the same problem appeared in Kateřina's left hip joint. She had tried treatment with the support of an Atlanta splint for a year, but the results weren't too promising. Therefore, surgical intervention was the next obvious step. Surgery on the right hip joint was carried out first and after a year the surgery of the left hip joint took place at the orthopaedic department of Motol Hospital. The goal of these interventions was to enlarge the roof of the acetabular fossa of the hip joint and improve the supporting surface for the movement of the femoral head. The surgical interventions were followed by many months in plaster casts reaching from the hips to the toes. After the casts were removed we began to carefully exercise with

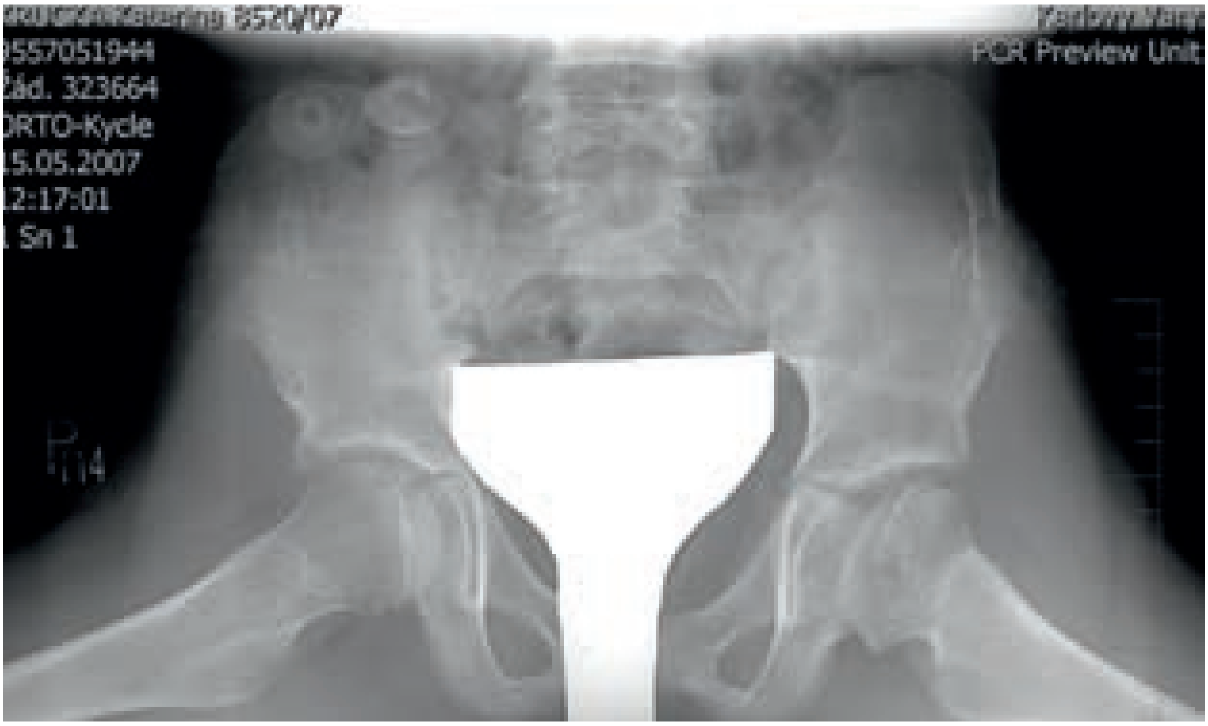
the classical Vojta method, and Kateřina returned to normal quite quickly.

When she was twelve, a quite sudden pain in the left hip joint reappeared.

X-ray images showed that the development of the head of the left hip joint is not favourable at all.

Kateřina hobbled on one leg while walking and after a while her leg and back started to hurt. In Motol Hospital, after looking at the MRI, we were told Kateřina had an troubling variant of Perthes disease. We were expected to deal with the fact that Kateřina would limp, wouldn't be allowed to play sports and when her growth would be complete in her eighteenth year, she would have to undergo total joint replacement. I found the same information in the existing professional literature. It is easy to imagine what this impairment of the joint "bearings" could do with the motion of the body in general. Moreover, Kateřina had such misfortune: besides the oval-shaped deformity of the head of the hip joint, the neck of the femur (tubular part beneath the head) significantly shortened. Therefore, her left leg was shorter by 5 cm. These changes in configuration and morphology of the whole hip joint cause its remarkably limited range of motion in all directions. The perspective of my daughter going through adolescence disabled, missing the possibilities to play sports, to dance (she had danced ballet quite nicely before her condition started), to run or even walk normally because of pain, came as a real shock to me.

I had previous experience that the Vojta method could improve several conditions like a crooked back or concave chest, but I couldn't find any mention that it could repair such a severely damaged joint. Still, something had told me that if the rule "Organ is created by its function," was valid, it had to always be valid; otherwise, it wouldn't have been a rule. Therefore, if I could evoke "the proper function", I would have been able to force the damaged hip joint to repair itself and possibly, to influence the shortened leg of our Kateřina. I tried to discuss the problem with some of my colleagues, but I couldn't find anything new.



So, we started to exercise Kateřina with the Vojta method. I gradually learnt I was probably following the right path, but the existing way of induction of the stimulation reflex to evoke the "right function" seemed to be too weak.

After six months, the check-up visit in Motol Hospital proved that the former significant restriction of the range of movement of the left hip joint decreased. The stereotypical gait improved and the pain while walking reduced. This reassured me that I was on the right path, but I needed to force the stimulation. I gradually attained it by adding foam balls to other reflex zones, by inclining the body on the tilted surface of the medical lounge in the longitudinal and transverse axes, by labilising the centre of gravity of the body and all limbs and, finally, by hanging the weights on the limbs. I prolonged the time of stimulation and, thanks to the balls, I could put many times more pressure on the reflex zones than I used to through digital stimulation.

So, we trained every day for months and years. After about two years, the stereotypical gait normalised gradually; the pain subsided, and the difference in length between the legs decreased to 2.5 cm. After another year, Kateřina began to attend athletic trainings and the year after that she competed in athletics at the Youth Olympics in Bahrain. Then, she grew bored with athletics and began to dance competitively. At the same time, she was playing the piano and singing.

In 2016, a check-up with X-ray and MRI showed that the head of the left hip joint was reformed into a spherical shape but was larger than the right one. The overall length difference between the legs was 0.5. Today, Kateřina is 21 years old. I think she had quite a pleasant childhood and adolescence. We train sporadically only to "tweak the form" for the dance. The eight month long preparations for the marathon run and the run itself represented an extreme test of the "quality" of not only the hip joint. Kateřina ran the race without greater problems. The hip joint has proved its function 100 % in this test.

I gradually came to realise how great the instrument for the repair of our musculoskeletal

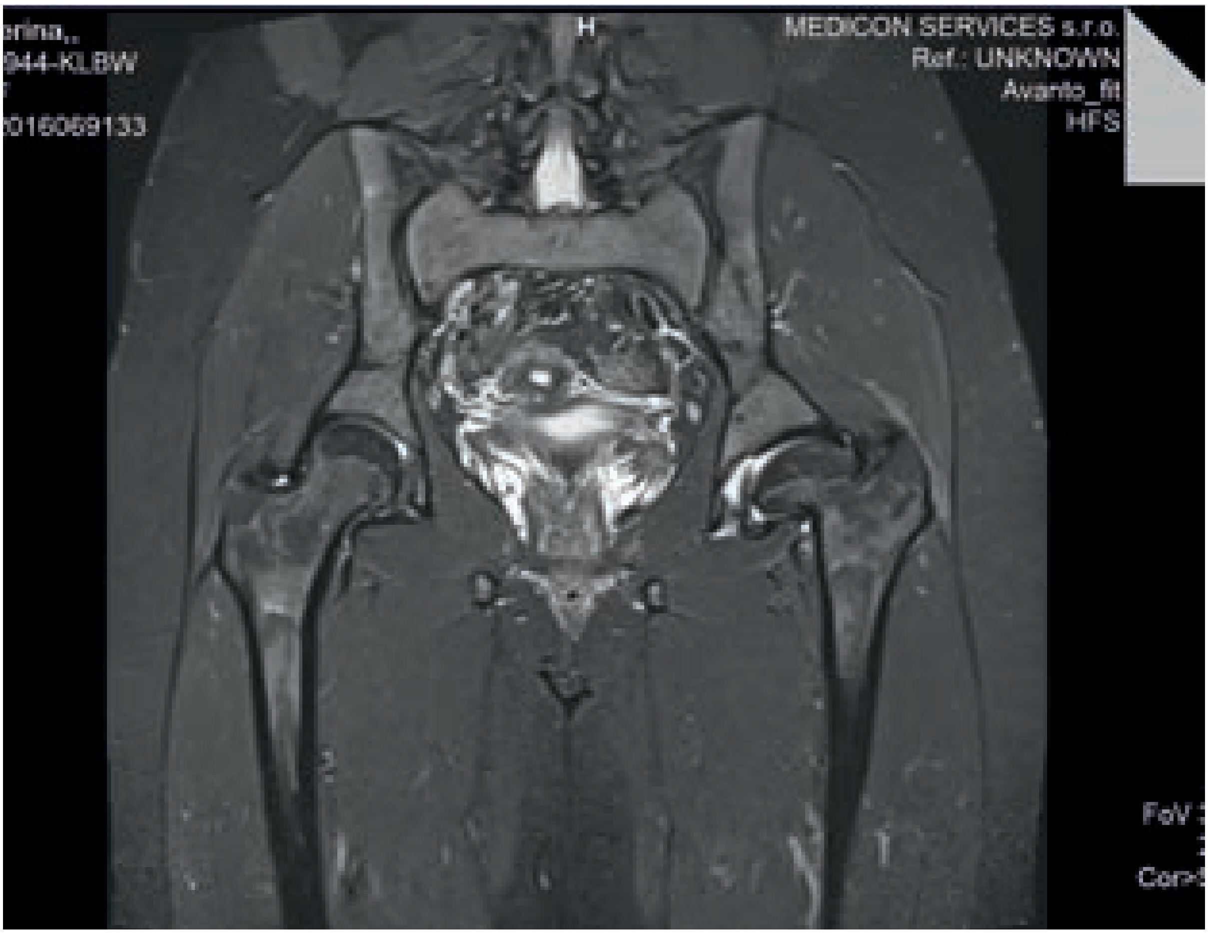
apparatus we possess. Nevertheless, the implementation of this therapy is connected with the hard work of the therapist, who must be highly motivated to endure such enormous difficulties. Since my father was a designer and I've seen him invent several improvements in my youth, I told myself that I should use the same method.

The process of implementation of the Vojta method I introduced several years ago is fundamentally identical to the process Dr. V. Vojta introduced for infants. Adult patients or older children exercise the therapy at home with a trained person (parent, patient's partner). The patient and his/her "home" therapist attend regular check-ups where the intensification and "adjustment" of the further therapy take place together. The very effect of the therapy in adults and older children intensifies many more times over.

Influence of Function on the Morphological Tissue Remodelling

In his book "Rehabilitation in the Clinical Practice", pages 411 and 412, P. Kolář has written:

"This process could be explained by an example of functional adaptation (remodelling) of the bone under pathological situations. Although many, particularly older, nomenclatures classify the bone among the inactive components of the locomotive system, it is, in fact, among the most active tissues of the human body. It not only contributes to statics and locomotion, but also to the process of permanent exchange of the very tissue and to the creation of other structures, concurrently. Bone is a highly active organ and its activity could be observed metabolically and morphologically. Arrangement of the trabeculae of the spongiosis corresponds with the trajectories, i.e. the lines connecting the places of the highest pressure and pulling tension. This finding constitutes the fundament of the bone transformation principle, as it's been first defined by Julius Wolff. His principle is a part of a law of functional



adaptation, which applies to all organs. According to Wolff's law, deformities of the bones appear as a functional adaptation to the changed shape or a changed function. Thus, the shape of the bone is secondary and co-decided particularly by the function. Consequently, the prevailing load of the bone leads to changes of intrinsic architecture and, secondarily, to changes of the outer shape of the bone. At this point, it is necessary to distinguish the adequate – physiological load and the inadequate – pathological load. The load of the bone is dependent on the external forces involved, particularly the most relevant weight force, but the intrinsic forces induced by muscles have to be taken into account too. We assume that the influence of the intrinsic forces is more significant, but difficult to measure. The tension of the muscles forms the axes of the bones and their shape and their posture within the joint. This process is of particular importance during the growth when the muscle forces have remarkable formative influence on the development and shaping of the whole skeleton as they affect the growth zones. Therefore, the muscle balance is extremely important for the development of the skeleton; the balance could be impaired because of a central disorder (CCD, CP, weak palsies etc.) or mechanical overload. This formative influence of the muscular imbalance is totally characteristic of the children with CP, in which the spasticity leads to predictable changes in the development of the hip and knee joints, the spine and other parts of the skeleton. In the case of the hip joints, there are insufficiencies of external rotators and abductors (mainly their posterior parts) and the predominance of the adductors that

lead both to anteversion and to the valgus posture of the proximal femur. Mechanical overload in children and adolescents has an important role in the development of the osteochondrosis and epiphysis growth impairments. In adults, the overload leads to an increase in bone remodelling apparent on the X-ray images. The bone is made denser – we speak of a so-called looser zone of remodelling. If the overload persisted, stress fractures would appear. The function has a fundamental influence on the balance between the processes of bone formation and reabsorption. It is a lifelong permanent exchange. The processes of formation and reabsorption are entwined and limited by physiological conditions of stimulation. To reach the balance, the mutual ratio of dynamic and static components must correspond. In practice, it means that every activity must be bilateral – dynamic-static. In ordinary practice, it could be demonstrated by the muscle activity during the isometric and isotonic movement of the muscle unit. Nevertheless, it couldn't affect the bone directly this way. Dynamic stimulation is represented by changes in the position of the body and its individual parts; the static stimulation maintains them. Under physiological condition, there is no separated dynamic or static stress. The preponderance of the dynamic load occurs in a decreased gravitational component – in antigravity, in motionless patients and, partially, in asthenic individuals. Conversely, the predominance of static load occurs in all cases of excessive weight and obesity or secondarily increased body weight (some professional and sports activities or the regular carrying of bags). Of course, this principle projects into the therapy as well. On one hand, we increase the static component – e.g. jogging in asthenic individuals by utilising the possibility of increased pressure on the load-bearing limb or by secondary pressure in the underlying surface, by carrying the load kept in a still position. If this component was outbalanced, we would have to reduce it by not only therapeutic interventions reducing the bodyweight, but by movement within the space with the decreased influence of gravity.

The process of the bone remodelling itself is launched by static stress as a component of the bilateral activity. (Every movement, although clearly dynamic, ostensibly contains a static component.) There is an activation of the mesenchymal cells that gradually develop their functional speciality. Concurrently, osteoclasts are also activated. (These are cells that participate in the degradation of the non-functional bone cells.) Activated mesenchymal cells differentiate *into prosteogenitor cells and then into pre-osteoblasts. Osteoclasts partially die and partially stay in resting phase. During the parallel dynamic stress, the process continues, so that the osteoblasts develop from pre-osteoblasts by modulation. In this transformation process, several hormones play important roles (parathormone, calcitonin). Calcitonin, for example, decreases the number of osteoclasts and potentiates the transformation of osteoblasts. Osteoblasts produce new bone tissue to an extent that corresponds with the extent of the old bone tissue disposed of by the osteoclasts. This is how the above-mentioned process of new formation and concurrent reabsorption takes place. The pathology could mostly manifest itself here, e.g., as a result of inadequate stimulation. The physiological and qualitative load in terms of an optimal ratio of static and dynamic components is determined by the body mass index (BMI) 18 – 25 and the environment. Besides the above-mentioned secondary influences, it is necessary to respect the contribution if the bone axis and the type of motion concurrently. The process of stress-dependent remodelling is often rather underestimated or even neglected in ordinary practice. The monitoring of the hormonal and enzymatic contributing factors dominates. It is particularly caused by the fact that the majority of the problems with bone structures is related to critical physiological phases of life – growth, adolescence and later, menopause. Nevertheless, some other pathological changes cannot be omitted since the issue of bone remodelling could be dominant in them.*

If we applied the rules resulting from the influence of the stress on the bone remodelling, we would definitely find out that the stimulation with increased load is adequate within preventive and treatment measures.

Video

Video – parta maraton
bit.ly/2ntjNsk

While rehabilitative care commonly involves both types of stress, the primary care, and thus everyday life, doesn't. They both appear in the education and promotion issues, but they still haven't become the routine part of the daily regimen. The introduction of jogging as a form of stimulation with a higher component of static load is typical (landing of the foot while running increases the load on the supporting limb three times more than a regular step). Conversely, swimming decreases the static component and could improve the dynamic domination. A targeted or spontaneous increase in antigravity effects may negatively influence the musculoskeletal apparatus: the joints develop the overload syndrome resulting in a higher risk of degenerative changes and in problems with circulatory and respiratory systems."

Jan Kolář has correctly stated that it's not so simple to "distinguish the adequate – physiological and inadequate – pathological (stimulation)." In terms of VM2G therapy, the form of physical activation with quite special, let's say, **physiologically formative** influence seems to represent the specific type of load on the whole musculoskeletal system. This type of physiological formation happens with the aid of central regulatory programs that are primarily responsible for the development of the skeleton in the first year of life.

A very important notion stated by Kolář is that the processes of formation and reabsorption are entwined and limited by physiological conditions of stimulation. To reach the balance, the mutual ratio of dynamic and static components must correspond. In practice, it means that every activity is bilateral – dynamic-static.

Based on many years of clinical experience with children and adult patients with a diverse spectrum of diagnoses, I think that through a conscious, active exercise method, it is practically impossible to achieve the ideal cooperation of dynamic-static load that could have had long-lasting and relevant influence on the formation of the musculoskeletal apparatus. I'm convinced the most essential influence is implemented through the activity of innate central programs of autonomic regulation of muscle tone, autonomic regulation of joint centration and autonomic regulation of muscle coordination. These genetically determined programs could not be changed or controlled voluntarily. They implement their physiological formative influence on not only musculoskeletal apparatus, but also the other organ systems. Under physiological conditions, the influence is clearly apparent during the development of the infant in the first year of life, when the general reconstruction of the body from the new-born to one-year-old walking child is most intensive. These programs and their formative influence could be therapeutically utilised within VM2G at every patient's age and in an extremely wide and growing spectrum of diagnoses.

20.1 The View on the Therapy of Daughter Kateřina

I was born with healthy hips. I'd been a healthy child until the winter of 1999, when on a skiing trip a sudden pathology appeared in my hips. Overnight, one leg became shorter and I felt a stinging pain in my hip with each step. From that day, my life and that of my parents became a long merry-go-round of examinations and X-rays with the final diagnosis – morbus Perthes. Doctors selected an Atlanta splint as a temporary method of preliminary treatment. I guess you all know the famous film Forrest Gump with the main character literally screwed together in splints. I looked like him, except I hid my "iron" beneath the skirts of a princess

dress for about a year. Unfortunately, the leg didn't improve and a more radical solution was adopted. So, I took a long trip to the surgical department of the Motol Hospital. I came back home unrecognizable – wrapped in a plaster cast from the waist down, except for the shin of the healthy leg. I was supposed to keep lying motionless in the plaster cast for two months, but while I was an active child, I used to jump around or at least, tried to walk on my healthy leg when my parents were of course out of sight. I guess they still haven't found out that I climbed up on the chair with my plaster cast and unlocked the safety lock in the upper corner of my sister's door. Luckily, none of my "illegal" plaster activities influenced the outcome of my hip surgery. Therefore, we could finally breathe, thinking it was all over. Unfortunately, it wasn't. The congenital defect appeared in the other hip, too. Thus, I had to go through all the days spent in a hospital room, at the surgical theatre or in plaster incarceration again. After two years in which I missed out on a "normal" childhood and one year of school, I could finally stand on my own feet again. Literally. The problem was that all my muscles had atrophied and I couldn't remain on my feet. My parents began to exercise the Vojta method with me and my condition improved quite quickly. Unfortunately, this was only until twelve years of age. At this point, I started to limp again and my left hip started to hurt so badly after a short walk that I had to sit down. We were at the Motol Hospital again. My parents were told that I was unlucky because

I should limp until adulthood and undergo left hip joint replacement at eighteen years of age. Of course, it seemed possible to live this way and I wouldn't have been the only child in this situation. But I had one great advantage compared to the others: my parents. The fact that they spent almost every day in the hospital with me, completely sacrificed 2 whole years, were able to take care of me and my three sisters at the same time, was just the beginning of what was going to come. I knew my father exercised with babies. But I wasn't a baby when I was seven let alone at twelve years old. So, when he decided he would exercise with me, I protested strongly – after one year, after three years, after five years, I just kept on protesting exactly the same way. Not only did I find it unfair that the others didn't have to exercise, but it was uncomfortable. When your own dad was your physiotherapist, you dared to try much more with him and vice versa. Each time, something pulled, hurt or stung me, I made it clear. And my personal physiotherapist and loving daddy, who were one in the same, adjusted the therapy to make it as comfortable for me as possible. He used to place underlay there, so it wouldn't be cold. He placed the ball here, so it wouldn't pull. He put the rubber here and the pillow there. And it really worked. I got better faster than anybody had expected. After several months, my mother, who used to talk me into it every single day for many years, was not the only one who could exercise with me – the whole family could. Someone held my hand, someone held my foot, somebody had to sit there and eventually swap with someone else because after a minute I overpowered most of the participants. Fortunately, there are so many of us.

As I look back, I don't think that there was anything wrong with my childhood. I couldn't sledge every winter, and I had to repeat the first grade at school, but I don't know anybody who

Illustration of a striking posture disorder of the right shoulder blade before the commmencement of therapy.

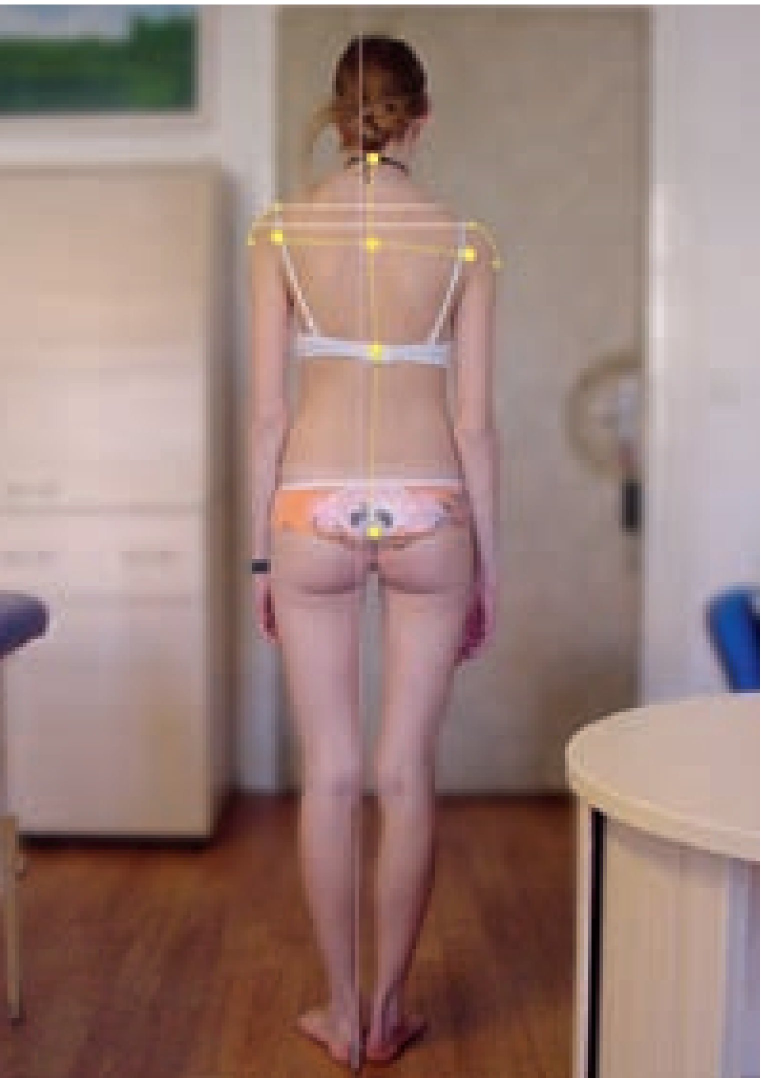


Illustration of normalised posture of both shoulders on the axis.

got as much parental care during their childhood as I did. That is the most important for me, and I remember it more often than I would remember running around our house. And now that we've come to running, I can move to the present day. After eight years of intensive Vojta method exercises, I don't have joint replacements and I don't limp. Except for about thirty stitches on my hips, you wouldn't recognise I had my hip joints broken into several pieces for a certain time. To put it briefly, even with such a diagnosis, one can dance competitively for several years. It is possible to train at the athletic club and fly to the Youth Olympics in Bahrain. One can train for a marathon on a daily basis and complete it successfully. One can exercise CrossFit and become a fitness coach. One can achieve what doctors couldn't even imagine. All you need is a devoted and kind mum and a great and intelligent dad who has thought outside the box and achieved the impossible.

Thank you, Dad.

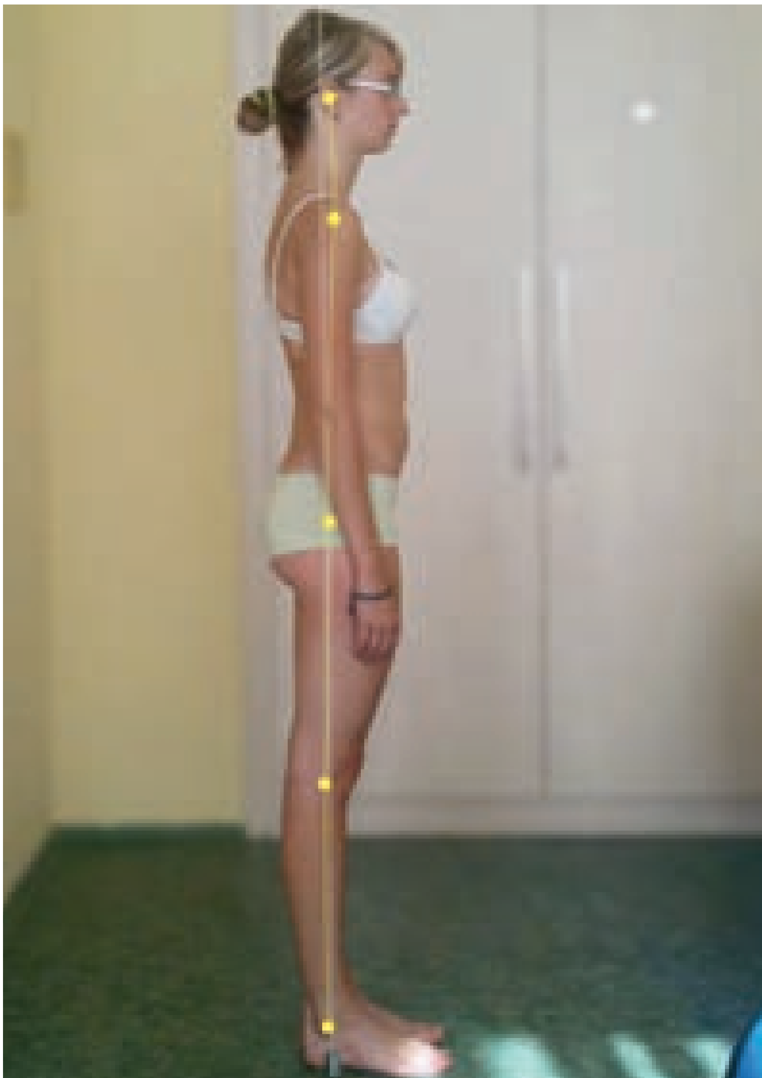
20.2 Case Study Šárka – VM2G Therapy in an Adolescent Girl with Acquired Developmental Disorder of the Skeleton

20.2.1 Illustration of the Problem – The Patient's Father Testimony

Our daughter had one slightly dropped shoulder since she was 11 years of age. Occasionally, we pointed out the problem to the paediatrician. He referred us somewhere else. We were advised to perform a few rehabilitative exercises by a specialist, but it was all somehow unsystematic – a few exercises and that was it. As time went by, the shoulder dropped even more. When our daughter was 14, an orthopaedist diagnosed her with spinal scoliosis. Examination at the

Side-on illustration of standing with noticeable ventral posture of the shoulder

Side-on illustration of standing with ideal posture of the whole body on the axis



specialised facility in Plzeň and the treatment with a corset followed. Though she just wore the corset for the night, it was still something we simply couldn't come to terms with. Standard rehabilitation was supposed to be part of the treatment. While we hadn't been satisfied with the previous course, we were looking for something different. We got the recommendations from our friends and visited Mgr. Krucký. This was something different – he offered to us long-term systematic care reimbursed by a health insurance company. We started unobtrusively with the Vojta method of 2nd generation at the earliest possibility. First, there was exercising with balls on the body under clothes and with the weights on the limbs. Then other balls were used, followed by more and more weights, rubber belts and underlays under buttocks. When we thought we had enough equipment, a request for a home rehabilitation adjustable medical lounge came. But we cheated and exercised on an old closet door placed and supported on the bed. The exercises changed gradually, and the weights on our daughter's limbs became larger. The daily home exercises didn't take very long, 10 – 15 minutes at the most. "Dressing" on the aids maybe took the daughter even longer. And so it went day after day for 4 years. About every 4 weeks, there was a check-up visit with Mgr. Krucký to check the "quality" of the implemented exercises and to correct them if necessary. Just this long-term care and his real concern were two of the reasons that made us persevere for so long.

The spine corrected itself gradually, as it was possible to show in the pictures with the plumb line next to the spine Mgr. Krucký regularly took. The problematic shoulder almost normalised. Today, our daughter is 18 years old. The exercises have finished, and our daughter stands straight. Everything is behind us.

Thank You, Ladislav Weber.

20.2.2 Description of the Problem (Clinical Findings)

The patient Šárka was admitted to our care at 14 years of age because of impairment to the posture of the body. According to X-rays, she was diagnosed with 25° scoliosis and the impairment of the posture of the right shoulder. The right shoulder stood 8 centimetres lower viewed from the frontal perspective. The overall posture of the shoulder girdle was moved significantly ventrally (see photo). The related impairment of the body posture also involved the posture of the head in the anterior shift and the posture of the mandible in retrogenia. An orthopaedist recommended the treatment with a corset supplemented by strengthening exercises. The parents decided on intensive rehabilitation with the Vojta method of the 2nd generation. In the first year, home therapy was performed by the patient's mother. The father, subsequently, took care of it because of the physical demands. They attended the regular monthly check-ups together. The exercise itself took place at home and took about 10 – 20 minutes. The asymmetry of Šárka's posture of the shoulders was apparent when wearing dresses, which had to be adjusted so that the shoulder strap didn't slide from the right shoulder. This naturally increased the patient's awareness of the discomfort. She was particularly worried about the future, which was the rather pessimistic because of medical prognosis regarding the normalisation of the condition of the musculoskeletal apparatus.

20.2.3 The Expert Explanation of the Problem

The physique of the patient inherited from both parents was rather gracile and slightly above average height. The musculoskeletal apparatus configured in this way is rather prone to development of impairments of the autonomic regulation of the posture. In Šárka's case, the development of the shoulder girdle was impaired yet in childhood following the incorrectly healed fracture of the clavicle and its subsequent shortening. Without doubt, this error in the treatment of the fracture of the clavicle was later manifested in the development of the impaired autonomic regulation of the whole body, particularly the scoliotic posture of the spine, slight deformity of the ribcage and protruding posture of the head with mandible in retrogenia. The effort to improve this condition with mechanical adjustment through a torso brace combined with strengthening and stretching exercises would probably lack efficacy. These interventions could hardly lead to restoration of the physiological growth of the shortened bone matrix of the clavicle and change the secondarily impaired regulation of the muscle tone and muscle coordination responsible for the scoliotic deformity of the spine and the chest. We can reasonably think that without adequate therapeutic intervention, the development of the musculoskeletal system of the patient, which was supposed to continue for about three years, would be accomplished under very unfavourable conditions. This impaired both the static and dynamic component of the locomotion.

20.2.4 Illustration of the Solution

The patient and her parents decided to undergo intensive VM2G therapy. The mother became the home therapist in the first year. In the next two years, it was the patient's father. They were all highly motivated, and the course of the therapy was exemplary. They bought an adjustable medical lounge, underlays, discs, balls, weights, antiskid mats and exercise rubbers. Home therapy itself was intensive and relatively short in duration, lasting for ten to fifteen minutes. Regular check-ups took place once a month and practically every time it was possible to increase the intensity. For example, the load on each limb in the end of the therapy reached two and half kilograms. Similarly, the tilt of the surface was fifteen degrees in the longitudinal axis and seven degrees in the transverse axis. This stimulation intensity was only possible because of the very good physical fitness of the patient's father. The overall duration of the therapy was three and half years. Throughout, we took photographic records of the changes in the posture of the patient's body from the posterior and lateral views. The possibility to monitor the improvements every six months was very encouraging for all participants. Similarly, the X-rays of the spine proved the improvement from former twenty-five degrees of the scoliotic deviation to twelve, and the last measurement showed only five degrees of deviation from the ideal posture of the body. The therapy was accomplished together with the graduation from grammar school and the admission to the university away from the patient's home. It was about time because the intensive daily home therapy would no longer be possible.

20.2.5
Explanation of the Solution

For patients with developmental disorders of the musculoskeletal apparatus, it is extremely important for the therapy to be initiated during the period of the growth. The repair of the regulatory programs is manifested during the therapy so that the growth of the body runs under the influence of the repaired program. The resulting effect is ossified, and there is no risk of future development of the difficulties with the musculoskeletal apparatus. With this patient, careful monitoring in the frontal and sagittal plane took place, which was photographically recorded. Gradual improvement in the posture of the right shoulder was apparent, from the former ventral and drooping posture to practically normal symmetrical and axially balanced posture. Similarly, the posture of the protracted head and the posture of the mandible in retrogenia normalised into physiological autonomic regulation of the posture of the head and mandible. After a year and a half, radiological monitoring showed the improvement of the spinal axis from the former twenty-five degrees to twelve; after another two years, the orthopaedist couldn't find any deviation of the spine. Achievement of this complex normalisation of the severe disorder of the posture of the body was successful because of excellent cooperation of the patient and her motivated parents, who well understood the possibilities of the VM2G for them and that the chances for improvement were limited to the period of their daughter's growth. The therapy was successfully accomplished with the graduation of the patient from grammar school. Despite the unfavourable prognosis, the condition of the patient has completely and successfully normalised. The therapy happened to prove

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as highly effective, and the costs reimbursed from the health insurance consisted only of rehabilitation consultation once a month, i.e. many times less than the price of the treatment with a corset would be.

20.2.6
The View of the Solution of the Developmental Problems with the Musculoskeletal Apparatus in Terms of VM2G

Repeated experiences with patients, who came with developmental problems with the muscoskeletal apparatus, has shown that the optimal approach would be focused primarily on the normalising of the regulation of the muscle coordination. This approach seems to be effective in various types of developmental disorders including those accompanied by acute and chronic pain. The positive effects of VM2G therapy were proved in patients with only functional impairments and in patients with clearly proved morphological changes as well. The ongoing period of growth is an extremely positive factor as it helps to "utilise" the therapeutically achieved changes. If the changes were built within the growing locomotive apparatus, it would be highly improbable that the locomotive apparatus would demonstrate any problems in the future. It's also very encouraging that other restrictions, such as painful conditions of the musculoskeletal apparatus, obesity, asthenic habit and decreased physical condition unlike in the fitness exercise and strengthening, do not represent any obstacles for VM2G therapy. A program of reflex locomotion is able to solve various restrictions through the intrinsic control and to find the optimal way to normal function of the muscle coordination.

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The therapeutic interventions themselves are successful under conditions of respecting the regular stimulation by the home therapist and attending regular check-ups. During adolescence, the therapeutic leadership of the adolescent teenage patient and the motivation of the parents to endurance and persistence in the home therapy can be quite challenging. Technical possibilities of the VM2G allow sensitive regulations of the stimulation load and setting of optimal initial therapeutic conditions. The susceptibility of the adolescent patients in the period to accelerated growth is an undeniable factor. In this period, certain disproportions occur between the sudden enlargement of the size of the body on one hand and the insufficiently adjusted "efficacy" of the CND on the other hand. Certain folk sayings describe the uncoordinated and ungainly movements of the quickly growing children. Temporary insufficiency of cerebral motor programs in this period is manifested in the therapy by the necessary reduction of the reflex stimulation. Therapeutic involvement of the coordinated muscle chains to activity has the formative influence on the musculoskeletal apparatus and its reconstruction. Other side effects of the stimulation consist of the inhibition and cessation of pain and the gradual improvement of physical condition including an increase in lung capacity. Gradual increase in the intensity of stimulation by tilting the medical lounge, labilising the supporting surfaces and adding the weights on all limbs proved to be very useful. Weights on the limbs stimulate force muscle loops responsible for the transmission of the forces between the pelvic girdle and the chest. Because of the labile supporting surfaces, the regulatory system is forced to intensive joint centration, particularly the spine itself.

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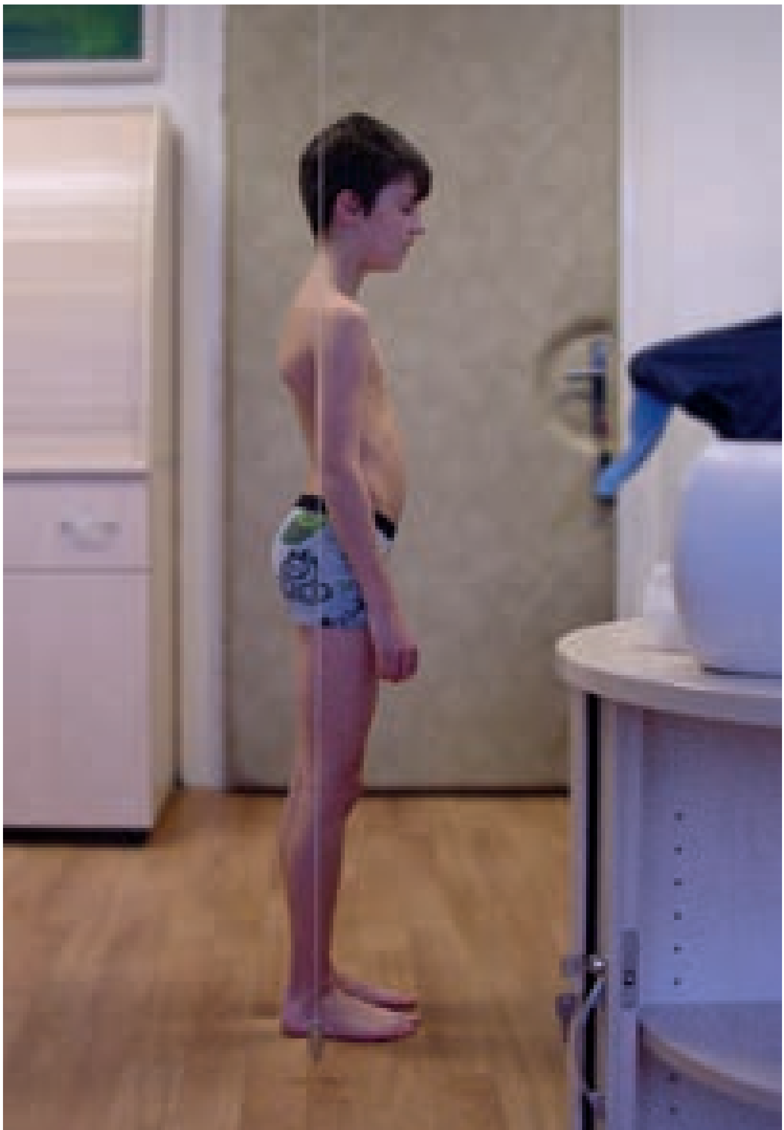

20.3
Reflection of the Father in the Role of a “Home Therapist” – It’s not simple, but it works!

I met Mgr. Václav Krucký at his expert lecture for hockey coaches, in which he introduced his view of the function of the human body. His method and philosophy completely impressed me, so my wife and I visited him with both of our sons (9 and 11 years). They both suffered from some obvious impairment. The older son Vašek had remarkable kyphosis and lordosis. Tomáš had them, too, as well as a unilaterally collapsed chest, which looked quite scary in combination with his body posture and “rachitic” build.

At that time, we had visited several orthopaedists, including the specialised facility at the Plzeň University Hospital. We got practically the same answer everywhere: “This is common and there’s nothing that can be done about it.” They told Vašek that one of his legs was shorter (when he stood, he bent one of his legs) and that a high insole would solve it. Supposedly, absolutely nothing could be done about the visibly collapsed chest of Tomáš, but it didn’t matter because it had no influence on pulmonary functions. Naturally, we were not satisfied with this “diagnosis” and the meeting with Václav Krucký changed our “lack of hope” to high hopes.

Since the very beginning, I’ve been very impressed by the way Václav Krucký has talked to us all the time, how he has patiently explained what to do and why, where the therapy should go and what we should want to achieve together. I like the way he studies the method and improves it in cooperation with various experts. He warned us openly about the fact that the older the children are, the longer the correction of each impairment

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takes. Thus, we knew what we were getting into and believed particularly that it would help the boys. What a change in approach and communication compared to previous doctors! Moreover, right during the first examination he found that Vašek didn't have a shorter leg but suffered from scoliosis, which has been subsequently verified by an X-ray.

We exercised daily with both boys for 15 – 20 minutes and after about a year we went to our paediatrician for a preventive examination. Although she had several hundreds of children in her care, she spotted the changes immediately. When the boys appeared at the door, her eyes widened and she said: "Hey boys, what happened to both of you? You're completely different!" She shook her head and couldn't believe what she was looking at and inspected our little boys with pleasure from all angles. You can imagine how we felt when our thorough doctor told us this, although she hadn't known that we had been exercising with Mgr. Krucký.

The boys "straightened" gradually. The changes were slow; exercises weren't fun anymore, but the idea of finishing and gradual improvement pushed us ahead. As time went on, we had to motivate the boys more cleverly, make compromises, but we kept on exercising quite regularly. When they finally began to grow, the changes appeared almost overnight. Today, they are handsome boys Vašek is practically perfect; Tomáš' back is nicely straightened. His winged scapulae and the collapsed half of his ribcage have begun to elevate.

At the age of 16 years, after about a year of resistance, Vašek refused to exercise any more. After consultation with our therapist we stayed with Tomáš, who keeps on exercising without any resistance. Because of chronic back pain, I've started to exercise as well, so I got an idea of what it's like. I must admit that the boys' achievements during those 5 years of systematic exercise are admirable. I am really looking forward to the moment when Mr. Krucký would say to us: "We're finished, you don't have to exercise anymore." And while this method functions through irreversible changes, it means that the repaired body and its software, respectively, could not impair again and will stay tuned forever and we can rest until the end of our days.

In finishing, I would like to say this demonstrably effective method is absolutely unique in our healthcare system, not to mention the approach and manners of Mgr. Krucký. And because the boys want to look good too, the exercise hasn't represented such a restriction for them. It's not free; it definitely isn't simple, but it is certainly worth it!

Zdeněk Kubálek

21. Theoretical a Practical Differences between the Classical Implementation of the Vojta Method and VM2G Therapy

21.1 Therapy of Infants with the Classical Vojta Method

- It is based on the biomechanical and anatomical concept viewed in 2D.
- It uses only the planar surface of the table without other aids.
- The stimulation is applied in two reflex zones.
- In most patients, it utilises all stimulation reflex positions, i.e. supine position, position on the side and prone position.
- Intensity of the stimulation may be increased or decreased in practice by the duration of the implementation of the therapy only.
- There is no psychological dimension to working with the infant, and it is mainly focused on the performance of the reflex exercise.
- It does not use any other stimulating, labilising, stabilising or adhesive aids.
- It does not utilise the influence of gravity, the direction of the fall lines of tilted planes or the combination of transverse-longitudinal tilts of the surface of the medical lounger.
- It doesn't systematically utilise the possibilities of the continuous neuro-kinesiologic diagnostics or retrospective assessment of the records of the results of such diagnostics. Diagnostics of infants remains in the hands of paediatricians and paediatric neurologists.
- The Vojta method performed in infants through the classical approach bears the risk of possibly inducing the pathological reflex response. Thus, it is necessary to perform it in a highly correct manner.
- The above-mentioned factors, consequently, have lower therapeutic efficacy. It is manifested in the limited therapeutic results in infants at risk of the highest degree of the central coordination disorder and particularly in infants with congenital developmental defects of the central nervous system. The development of these children mostly leads towards some type of cerebral palsy and related psychomotor retardation.

21.2 VM2G Therapy for Infants

- It is based on the biomechanical and anatomical concept seen in 3D.
- It systematically utilises the biomechanical concept of muscular spiral loops.

- In the practical treatment, it uses the medical lounge tilted in the transverse and longitudinal axes and many other aids including the children's adjustable medical lounge for home exercise loaned or sold to the parents.
- Stimulation is performed in several reflex zones. There are up to twenty-two zones that could be used at the same time.
- Most infant patients can get by with the use of the reflex exercise in the supine position, which is very comfortable for the child. The exercise on the side and the stomach is used in about 10 % of cases.
- Head zones are not utilised in VM2G method as it is uncomfortable for children. These zones are rarely used in infants with palsy of facial muscles.
- Intensity of the reflex stimulation could be increased or decreased by several techniques:
    - The gradual tilt of the surface of the children's adjustable medical lounge. The tilt can increase the effective intensity of the therapy or, conversely, the opposite tilt of the fall lines leads to facilitation of the induction of the stimulation. Thus, the strength of the stimulating reflex decreases (photos and videos);
    - Gradual adding of stimulating balls to reflex points can induce very fine regulation of the intensity of the therapeutic effect and a more exact local focusing of the therapy;
    - Adding small weights to the limbs and the possibility of their cranio-acral shift could significantly strengthen the course of the reflex;
    - The use of labile supports by inflatable discs and balls to puncta fixa on the body and the limbs can both intentionally regulate the direction of the intensity of the reflex and eliminate the creation of excessive reflex muscle response. Maintenance of these large muscle responses is unnecessarily exhausting for the exercising parents, and in the long run, it can lead to overload and pain in their muscle insertions in the forearm.
    - The use of adhesive mats significantly improves the targeting of the reflex and it also allows simple and efficient prevention of the undesirable movements of the infant. These mats are also used to remove the excessive reflex forces that make the therapy too physically demanding for the parents.
    - In cases of severe diagnosed central coordination disorders and proven developmental defects of the CNS that significantly put the future psychomotor development of the infants at risk, the use of **stimulating therapeutic dress** has proved to be beneficial. It allows the inducement of the therapeutic reflex with an extraordinary intensity that can be regulated electronically as needed.
    - The combination of the above-mentioned stimulation techniques enables precise variations of the performed stimulation therapy of the infants and allows the adjustment of the therapy according to the actual status and developmental degree of the infant as well as the possibilities and physical capabilities of the parents exercising with the children.
- The duration of each session of the implemented therapeutic stimulation

doesn't have to be too prolonged thanks to the use of stimulation techniques. Consequently, it increases the comfort of the child and the exercising parents. The total completion of therapy is recommended after the accomplishment of basic motor development. This ensures that the future autonomic regulation of the posture of the body and its basic stereotypical movements would be completely alright. This prevents the development of motor disorders of the gross and fine motor skills including muscle discoordination into the future.

- There is a focus on the continuous psychological work with the infant within VM2G therapy to habituate the child to the situation of the therapeutic stimulation. The parents are also provided with psychological support to motivate them in the therapy and to overcome crises that necessarily accompany the therapeutic process.
- Before the initiation of the VM2G therapy itself, a thorough preliminary diagnostic examination of the child takes place. During each follow up, continuous thorough neuro-kinesiological examinations take place through observation of spontaneous and elicited motor skills, particularly by positional tests. Careful monitoring of the condition of the CNS of the infant is the basic precondition for the implementation of the exact, focused and adequately intensive therapy. Video recordings are made for every child in all therapeutic sessions for retrospective evaluation of the results of the diagnostics and for supervision check-ups. This allows for the easy organisation of an expert teleconference in cases of diagnostic and therapeutic doubts. For the therapeutic assessment of the spontaneous motor expressions of the infant, it is a great advantage to use the video recordings of the child's parents as it facilitates the creation of a realistic picture about the motor expressions of the child in his/her home environment.
- The performance of VM2G therapy in infants bears no risk of inducing a pathological reflex response because it works in ON – OFF regimen, i.e. the reflex runs correctly or it doesn't run at all. Fears of inducing the pathological response are groundless.
- The summary of these diagnostic and therapeutic measures is represented at a high level of therapeutic efficacy in infants at risk of all degrees of the central coordination disorders and in infants with diagnosed congenital developmental defects of the CNS. If these disorders were diagnosed early, the therapeutic efficacy would practically achieve 100 %. Subsequently, it can prevent the development of the cerebral palsy and the related psychomotor retardation.

21.3 Classical Vojta Method Therapy with Preschool Children

- Most often, it is used with children with developed cerebral palsy impairment.
- To keep the child in the necessary reflex positions, forced stimulation zones are implemented along with the restraint of excessive and disturbing movements of the child. This results in displeasure and, consequently, children try to avoid the pressure of the fingers and hands. Therapists and parents are subsequently

forced to further increase the pressure.
- The method of stimulation and lack of possibility to explain the importance of the therapy to the children rationally lead to psychological tension between the parents and their children. It is very challenging for the therapist to succeed with the available method of treatment.

21.4 VM2G Therapy with Preschool Children

- From the age of 1 to about 5 years of age, it is possible to implement the VM2G in children with CP and in children with less severe developmental impairments of the autonomic regulation of the posture of the body and the regulation of the basic stereotypical movements.
- The most typical patients at this age are the children with impaired stereotypical gait, most apparent in turning the toes inward while walking, sometimes in the stumbling and falling because toes cross while running.
- The important part of VM2G therapy is the preparation of the children for the therapeutic stimulation itself. Non-forceful implementation and gradually distracting the child's attention from the reflex stimulation must prevail. The goal of this approach is to form the preconditions for the gradual process of mental habituation of the child to repeated home therapy situation.
- It has proved to be beneficial to implement the VM2G therapy during the sleep in the children with diagnosed CNS disorders in terms of "light brain dysfunction". They are very hyperactive and suffer from concentration disorders, so it is extremely difficult to distract their attention. There have been proven results in the improvement of the regulation of the motor skills and in maturation of the superior brain structures with subsequent reduction to complete remission of the brain's functional impairments.
- VM2G therapy enables gradual and non-forceful increasing in the reflex stimulation with technical tools.

21.5 Classical Vojta Method Therapy with School Children, Adolescents and Adult Patients

- The Vojta method is used in many motor disorders in older children, adolescents and adult patients. The complication that is similar to younger groups of patients is the very implementation of the reflex stimulation through two points stimulated by the fingers of the therapist. This form is very exhausting for the therapists and parents who practice the therapy at home. Biomechanical preconditions of the larger body create a strong reflex response based on the premise: "The action induces the reaction of the same intensity and opposite orientation." The exercise becomes physically demanding; sometimes it's almost unbearable. Thus, the duration of the stimulation is restricted to tens of seconds. Too short duration of the stimulation and the impossibility to increase the intensity of the therapy result in insufficient utilisation of the possibilities offered by the Vojta method. Concurrently, the physical demands on the therapists and the parents of the patients is limiting and often leads to a reduction in the number of therapeutic sessions and ending of the Vojta method therapy. Patients who undergo the classical Vojta method perceive it as uncomfortable and even painful at the place of stimulation.

- The therapy doesn't use any other stimulating, labilising, stabilising or adhesive aids.
- It doesn't use the influence of gravity, fall lines of the tilted surfaces or the combination of the transverse-longitudinal tilts of the surface of the medical lounge.
- The above-mentioned factors result in lower therapeutic efficacy and limited therapeutic results.

21.6 VM2G Therapy with School Children, Adolescents and Adult Patients

- It uses the surface of the table tilted in the transverse and longitudinal axes and several other aids in practical therapy.
- Stimulation is implemented in many reflex zones. There are up to twenty-four reflex zones that can be used concurrently.
- In the utter majority of patients in this age group, we can get by with utilisation of the reflex exercise in the supine position, which is very comfortable. The exercise on the side and in the prone position is used only in about 5% of cases.
- The intensity of the reflex stimulation in the basic supine position on the medical lounge without tilt could be increased and decreased by several techniques:
    - The gradual tilt of the surface of the children's adjustable medical lounge. The tilt can increase the effective intensity of the therapy or, conversely, the opposite tilt of the fall lines leads to facilitation of the induction of the stimulation and the strength of the stimulating reflex decreases (photos and videos);
- Gradual adding of stimulating balls to reflex points can induce very fine regulation of the intensity of the therapeutic effect, and more exact local focusing of the therapy.
- Adding small weights (0.5 to 2.5 kg) on the limbs and the possibility of their cranio-acral shift could significantly strengthen the course of the global reflex.
- The use of labile supports through the assistance inflatable discs and balls for puncta fixa on the body and the limbs can both intentionally regulate the direction of the intensity of the reflex and eliminate the creation of excessive reflex muscle response. Maintenance of these great muscle responses is unnecessarily exhausting for the therapists and exercising parents. In the long run, it can lead to overload and pain in their muscle insertions in the forearm.
- The use of adhesive mats significantly improves the targeting of the reflex. These mats are also used to remove the excessive reflex forces that make the therapy too physically demanding for the parents.
- In cases of diagnosed severer disorders, the use of stimulating therapeutic dress has proved to be beneficial. It allows the inducement of the therapeutic reflex with extraordinary intensity that could be regulated electronically as needed.

    - The combination of the above-mentioned stimulation techniques enables precise variations of the performed stimulation therapy in the children, adolescents and adult patients. It also allows the adjustment of the therapy according to their actual status. VM2G therapy respects the possibilities and physical capabilities of the therapist, parents or partners exercising with the patients at home.
- The duration of each session of the implemented therapeutic stimulation doesn't have to be too prolonged thanks to the use of stimulation techniques. It increases the comfort of the patient and all people exercising with them.
- It is interesting that the effect of the VM2G therapy has also been proven in a patient in vigil coma.

The set of these therapeutic factors has been proven by high therapeutic efficacy in several disorders of the musculoskeletal apparatus. The use of VM2G seems to be efficient in all age groups up to elderly patients in their nineties.


GER TROPHY

22. Parents's Questions

When the child cries during the exercise, does it meant he/she's being hurt?

The crying of the child (during the exercise) has several causes:

- For new-borns under 6 weeks of age, the cause usually is insufficient thermoregulation. If such a small child was undressed for a longer time, it would get cold, and logically the discomfort would be manifested in crying. It's better to keep the child lightly dressed and to ensure adequate warmth in the room where the exercises take place.
- 2. Another quite common cause is the so-called "positional insecurity of the child's body". It means the child with motor immaturity couldn't regulate the centre of gravity of its body. If this immature child was laid on the surface, it would present its instability and hand out to find the stable support. This condition is unpleasant for children, so they express their discomfort by crying. If we held them in our arms and created a stable support, they would be pacified. During the exercise, there reflex elevation of legs and the head or stepping. It also increases the perception of positional insecurity and leads to anxious reaction and crying.
- 3. Perhaps the most common source of crying in children during Vojta therapy is incorrect communication with the child. Children under approximately one year of age have a so-called "omnipotent" way of communicating. They dictate "how and when the talk would take place". The child really initiates, steers and concludes the communication. It's an innate nonverbal pattern. If the child exercised with the Vojta method "strictly", if there was no communication and "explanation" that nothing wrong was going on, it would start to feel insecure and anxious and start to cry. It's necessary to communicate with the child permanently during the exercise even if it wasn't in the mood for training. What really helps is to induce the positive atmosphere without nervousness. Also, the regularity of the exercise helps the child to get used to the stress mentally, physically and in terms of its biorhythms.
- 4. If the source of crying was pain, it would always be a mistake! Pain induces a protective reaction that disturbs the reflex exercises. Moreover, the crying caused by pain persists even if the child was held in the arms. This crying is different and parents quickly recognise that it's "serious crying" signalling the danger.

Couldn't I hurt the child before I learn the exercises properly?

Even when the exercise is not performed completely correctly, it is very important because the child gets used to it gradually. However, exercises that are not always performed perfectly cannot be harmful.

Is the exercise difficult? Could a single person handle it?

In small children under one year of age, one person can handle it without any problems. If there was a helpful father or grandparent, it would be very practical to alternate between the exercises. Rarely, it is necessary that both parents perform the training.

Are there any special aids we could use?

VM2G uses several aids that significantly facilitate the training – balls, elastic bandings (could be obtained in shops with medical supplies), labilising discs, wedges or children's medical lounge, which can create tilted training surfaces. Another aid would be training dress, which has contained stimulation balls already. The balls in the training dress can implement not only pressure stimulation but also stimulation with vibrations.

Is the Vojta method absolutely for everyone?

The Vojta method shows a great deal of promise. For small children, it mainly concerns disorders of motor development (central coordination disorders, tonic disorders – muscular tension), status post peripartal fracture of clavicle, underdeveloped cores of hip joints and predilection in the posture of the head (inability to turn the head to both sides). In older children, the potential benefits are in the treatment of common disorders of the posture of the body, scoliosis, etc. In adults, Vojta method is performed in the case of several disorders of the musculoskeletal apparatus. Caution would be needed in children with proven and unstable epilepsy.

Under which occasions it would be necessary to discontinue the exercises? (illness, vaccination...)

Exercise should be discontinued for 3-4 day because of vaccination, particularly if the negative reaction has appeared (fevers, sleepiness, fatigue). Common diseases (cold, viral diseases) require discontinuation of the training only during the period of fevers or fatigue of the child. Otherwise, there are no limitations.

What happens to the body during the exercise?

By stimulating the reflex zones, the body launches (i.e. the stimulation causes specific response) its "repair program". See below. In 1950s MUDr. V Vojta discovered general rules of kinetic development of children from birth to the period of unaided locomotion. He studied these rules in order to find a rehabilitative methodology suitable for the children that were affected by disorders of musculoskeletal apparatus (mostly after cerebral palsies). He knew that the normal motor development had its order, through which every healthy child must go. However, because he was a brilliant observer and a great neurologist, he discovered that handicapped individuals also experience development that results in so called pathological stereotypical movements. We carry normal stereotypical movements in our genetic equipment into adulthood. Also, the pathological patterns of motion are "secretly carried" in traces of memory.

Disorders of musculoskeletal apparatus during the development and in adulthood can launch the pathological stereotype. We could say that physiological (i.e. healthy) stereotypical movements represent "operating programs" of the basics of locomotion for our brain (turning, righting, gait and grip). They can be compared to operating programs in a computer. If it didn't work, no "special applications" of locomotion would work either. This developmentally younger and more fragile "operating program for physiological basic movements" could be impaired somehow, e.g., by stroke or joint surgery. In this case, the brain would use developmentally older operating programs. But they know only pathological stereotypical movements. This primitive operating program is not able to launch "extension applications of kinetic programs" at all (e.g. jumping, dancing, playing the piano and other learned motor skills), or it launches them in a crooked and faltered form, which becomes apparent during the locomotion.

The goal of every rehabilitation is basically to return to the developmentally younger operating program that can repeatedly launch complex kinetic applications in completely normal form.

The genius feature of the Dr. V. Vojta's discovery has been the fact that from the moment of birth, the brain has stored a "backup repair program" we had been given by nature. This ability could generally be classified with other so-called "self-healing" mechanisms of the body, represented by, e.g., healing of the bone fracture or injured skin. For the normal and successful course of the healing process (e.g. bone fracture) it is necessary to provide adequate conditions – fusing of bony fragments, rest and no physical strain. Also, for the "commencement" and successful course of the treatment of the disorder of the musculoskeletal apparatus through this backup program, it is necessary to fulfil certain proven conditions – defined position of the body, stimulation of the "trigger reflex zones" on the body and reflex (unconscious) movement.

We can distinguish two types of these movements – reflex crawling and reflex turning. As time goes by, they have been modified. Practically, it is isometric movement, like if we really "froze" the movement in a certain phase. By temporal and spatial summation of the impulses that return to the brain, we can achieve much higher efficiency. Thanks to this feedback, the repair program is able to "fill in the missing impaired or damaged information and files". This is how the basic physiological operating program for motion "gets back to work" to the greatest extent possible. This program is necessary for physiological stereotypical movements that subsequently enable the running of the extension and complex "application programs" of locomotion.

The treatment method has been called "the Vojta method" after its creator. First, it was used to great success only in small children at risk of impairment of motor development. Because of incredible brain plasticity, this repair program is able to cure even considerable motor impairment.

How long after meals can I begin to exercise with the child?

In small, exclusively breastfed children under 3 months of age, the exercise can start after about 15 – 20 minutes. In most of children, who take solid food, it's better to wait at least 30 minutes. The Vojta method has a significant effect on the whole digestive apparatus as it normalises smooth muscle tone of the stomach and the intestines. It facilitates the mobility of the food in the digestive tract and secondarily, it improves defecation. In small children, vomiting during the start of the exercise subsides quite quickly because of the above-mentioned mechanism.

What is the best time for the last daily exercise so that the child wouldn't be tired or wouldn't in the end have problems with going to sleep because of stimulation?

The common practice has shown that it's suitable to perform the last exercise before the evening bathing of the child. It induces general tranquillity and relaxation of the child before going to bed.

How can I recognise, that I should start to exercise with my child? Can I recognise it myself or should I visit the doctor?

Every mother has an innate sense for her child's development. She subconsciously monitors its various manifestations, especially:

- the strength, intensity and clarity of its vocalisations when crying, murmuring and screaming,
- the muscular tension of the body, "how the child behaves in her arms",
- how a child lies on a mat or blanket and whether it bends its back,
- how it lifts its head and whether it takes a step,
- whether it relaxes its fist into an open hand, how it grips toys.

If the child's physical manifestation doesn't correspond to the mother's natural expectations, it can arouse in her unease and anxiety, and she will start to seek help and explanations. Dr. Vojta had a great respect for this natural maternal instinct. He never underestimated it and never played down a mother's fears. In fact, above his surgery door was the sign:

"THE MOTHER IS ALWAYS RIGHT!"

If a mother is dissatisfied with "something" in the development of her child, which she isn't able to precisely describe, it is imperative to seek professional help. Real professional help is never reassuring words that the "child is lazy", that "he/she will grow out of it" and that "each child is different." These and similar reassurances prove that the paediatrician in question isn't able to properly examine the child with regard to psychomotor development. He/she isn't able to clearly delineate what developmental stage the child is in, why the child behaves in such a way and isn't familiar with developmental screening, which would provide a reliable basis for distinguishing whether a child is developing completely normally or whether there is some deviation in the development.

These deviations can in principle be divided into:

- mental development disorders (e.g., Down syndrome)
- physical development disorders, the so-called central coordination and tonicity disorders.
- mixed type disorders

It is also a matter of the degree of the disorder, i.e. very mild, mild, moderately severe and severe.

A mother who brings her child for an examination, suspecting that there is something amiss in her child's development, should not in any circumstance receive a vague statement. She should assertively request a clear and expert answer.

This is precisely what they pay their paediatrician for. If she doesn't receive such a clear answer, it is her duty to seek professional help from a different doctor.

When is it possible to begin to exercise with my child?

If necessary, the exercise could start soon after birth (on 2nd to 3rd day).

What is the latest time possible to begin to exercise with the child?

It can be said that if there is a disorder of any type in a child, postponing exercise is detrimental because it reduces the chance of normalising the disorder (or contributing to its significant reduction).

During the first year, the maturing brain is incredibly "plastic". Dr. Vojta used to say that the brain is "pregnant" with possibilities. The developing brain matter is able to create many substitute connections, which allow it to compensate for and even completely eliminate a serious defect. A defect means an anatomical disorder, e.g., destruction of portions of the cerebral tissue from postpartum haemorrhaging or damage from new-born jaundice or functional disorders, e.g., the insufficient creation of functioning neural networks, which is essential for the function of an otherwise intact brain.

The sooner the exercises start, the better the outcome is.

Why does the child sometimes cry and sometimes have fun when performing the same exercise?

At the beginning of the training, the child perceives "positional insecurity", which is unsettling. Repeated exercises create brain connections that allow the child to "control its centre of gravity" in the respective position. This leads to cessation of feeling of uncertainty that evokes anxiety and subsequent crying. Conversely, once the child is certain in the position, it "enjoys" the possibility to preform many new "funny" movements that used to cause anxiety. It could be compared to learning to ride a bike. In the beginning, the child is also very uncertain. It often has pupils dilated in anxiety. But as it gradually manages to balance and coordinate pedalling and driving concurrently, euphoria appears because of these new locomotion possibilities.

How long will I have to exercise with my child? When is it possible to end the training?

Exercises are worthwhile until the development of the child is normalised. This is individually specific. It depends on the type and the degree of the disorder. The quickness of normalising is also dependent on the time when the exercises began. The sooner the disorder is discovered and the exercises are initiated, the quicker the normalising of the motor development is. Unfortunately, the reverse also holds true: late diagnosis and treatments results in delayed normalisation.

What would be the consequences, if we didn't exercise with our child?

The consequences of not paying attention are also individually specific. It depends on the type and the degree of the disorder. Central moderate and severe coordination a tonicity disorders may develop into some type of cerebral palsy. Cerebral palsy is a serious developmental disorder of the motor skills of the musculoskeletal apparatus, to which the child "grows into" without early diagnosis and subsequent intensive therapy.

Of cause, there are very severe, mostly combined disorders that have a serious prognosis despite good care. Fortunately, they occur very rarely. Very mild and mild disorders tend to impair the so-called "autonomic regulation of the body". These children develop disorders apparent in standing and in walking as well. The stereotypical gait is impaired by inner rotation of hip joints with concurrent inward turning of the toes. The frequent cause is the impairment of the correct development of the longitudinal and transverse arch of the foot. The other serious developmental disorders appearing resulting from the lack of early care are represented by defects in the posture of the body:

- Inward turning of the toes
- Inward rotation of the knee joints and the valgus position
- Anterior pulling of the pelvis
- Increased bending in the lumbar region
- Weakening and bulging of the abdominal wall, often combined with weakening of the tendinous midline connection of the straight abdominal muscles with the tendency to develop umbilical and abdominal hernias
- Protrusion of scapulae and anterior inward rotation of the shoulders
- Disorders of the configuration of the ribcage, most often its inner collapse and subsequent disorders of the coordination of the stereotypical breathing
- Side deviation of the spine – i.e. scoliotic development
- Anterior pulling of the head
- Disorders of the posture of the mandible in terms of autonomic regulation of the closing of the mouth; concurrent development of an incorrect overbite because of the shift of the mandible, impaired dental occlusion and increased carious lesions. (Children tend to prefer the breathing with mouth.)

There are several developmental disorders that are manifested gradually during growth.

Beside these disorders, impairments of the development of coordination of fine motor skills subsequently appear. They consist of problems with writing, reading, wrong coordination of ocular and articulation muscles and manual clumsiness, e.g., when learning to play the musical instruments.

Developmental disorders of the gross and soft motor skills largely contribute to the development and subsequent maintenance of the so-called "mild brain dysfunctions".

Who would teach me the exercises?

Therapy using the Vojta method and VM2G is conducted by experienced physiotherapists. Admission in the therapy is responsible decision and it has to be approached in this way.

Is it true that a child that has exercised with the Vojta method, becomes physically fit earlier? (crawls and walks earlier)

Yes, it's been demonstrated that children diagnosed with very mild and mild developmental disorders have faster maturation of cerebral structures thanks to the Vojta method. They build richer neuronal networks, which are the essence of good performance and capacity of the brain. It's not rare that these children can stand and begin to walk before their 10th month. Their motor coordination and handiness is highly matured.

The degree of maturation of gross motor skills also appears in the faster maturation of the fine motor skills (dexterity of the hand, matured manipulation with toys, drawing...), and in the overall psychomotor development (active use of language, musicality, better ability to build social contacts, etc.)

Does the training of the Vojta method help with increased salivation in small children? If it does, until what age?

The exercises normalise all stereotypical movements in every age.

Increased salivation is an impairment of the autonomic regulation of the swallowing of saliva. Physiologically, it occurs in small children under about 3 months of age, then the ability to continuously swallow the produced saliva appears to prevent its spontaneous leaking from the mouth.

In central coordination disorders in the first year of life, persistent spontaneous leaking of saliva often continues because of the disorder of the autonomic coordination of swallowing. Spontaneous leaking of saliva is a severe problem in mentally impaired people. With correctly guided exercise, correct autonomic swallowing of the saliva could be achieved in these patients. In adults, this problem may occur after a stroke, but quality exercise can regain the normal swallowing of saliva.

Could the exercise negatively influence the mental wellness of the child? (The child does something it doesn't want to, something unpleasant and unnatural...)

Existing research proved the opposite. Children who exercised with the Vojta method had a better relation with their parent – therapist than with the parent who didn't participate. It's not easy to explain why it is this way. The child perceives unconsciously that the parent doesn't want to hurt but help. Despite fighting back and resisting the exercises, a strong positive relationship is being built. From the view of the immature ego, the non-exercising parent seems be less interested in the child than the parent that exercises. Within the course and after the exercise, the child has to be soothed. Soothing is achieved by intensive physical contact, which is very important for the development of the future positive relationship.

What are the undesirable effects of the exercise?

The Vojta method has been used for more than 50 years, and the observed side effects of the exercise were essentially positive. Apart from focusing on the normalising of the disorders of the gross motor skills, it appears that there is demonstrable positive influence on the superior nervous functions, including cognitive functions, e.g., normalising the stereognosis (the ability to identify the object by touch), normalising the disorders of the fine motor skills (writing, drawing), normalising the disorders of reading, normalising the hyperactive manifestations in children with MBD. Normalising of the strabismus could often be encountered, which is caused by incorrect coordination of ocular muscles.

Is the regularity of the exercises important?

The regularity is very important. Creating daily schedule of exercises with the child is fundamental. The child adjusts to the regularity more easily. It creates a habit and biological stereotype, which helps him to tolerate the exercise better. Regularity is a very important factor of success.

How many times a day and for how long should we exercise?

The schedule of exercises is individually specific and depends on the age of the child and the type of disorder. Generally, we can say that small children under one year of age should exercise 4 times a day, the older children once or twice a day. The duration of the exercise to start with in small infants is 0.5 minute and the stimulation is increased to 1 minute, i.e. the duration of the effect of one exercise on one side. Of course, it's necessary to exercise on both sides symmetrically. For older children, the duration of the stimulation could be individually increased to 2-3 minutes.

Can I overload the child with long exercise?

Long-term experience with implementation of VM2G has shown that the therapy implemented this way is absolutely safe. If the exercise took too long, the reflex stimulation would switch off automatically.

If I stopped exercising for some time, would it mean that I would impair the created stereotypes and return to the beginning?

This is a bit more difficult question. In small children under one year of age, when the basic stereotypical movements are being created very intensively (righting, autonomic regulation of standing, stereotypical gait and grip), it is absolutely necessary to secure continuous building of these cornerstones of the motor skills. Thus, it is recommended to interrupt the exercise only for the necessary period, i.e. after vaccination or fevers.

In the first year of life because of cerebral plasticity, there is a great chance of normalising of many disorders of the musculoskeletal apparatus. In older children that have accomplished the “cornerstones of the motor skills”, the break doesn’t have such shortcomings.

In older children, the created stereotype is recreated, improved, optimised and tuned by the exercise. If the “foundations and gross foundation work” has been built, they would remain standing, no matter if you halt the construction for some time. If the break was too long, gradual “erosion” of the created physiological stereotype could appear with subsequent replacement with the pathological stereotype.

Are the results of the exercise permanent?

Yes, the results of the exercise can be considered permanent because they have been created by the changes within the brain tissue (creation of a denser neural network with richer connections). This is manifested in normalising and tuning of the regulation of the stereotypical movements and in changes in the musculoskeletal apparatus – correct joint centration, correct setting of the autonomic regulation of the posture of the body (ideal curvature of the spine, posture of the pelvis, shoulder girdles, etc.).

How to make the exercise more pleasant for the child?

First, it's important to create adequate external conditions that would be pleasant for the child. In infants, it is the thermal comfort since their thermoregulation is not adequate and they get cold quickly. The temperature at the place of treatment should be increased to 24 through 26 °C. Securing a calm and cosy atmosphere is necessary. It is unsuitable to let an older sibling disturb and demand attention. The tender-hearted laments of grandmothers over "the torment of their little darling", the grand child, are unsettling and unnecessary. If your close relatives and friends can't help, arrange it so that they can't interfere. The place where the exercise takes place (table or changing table) must be stable, with a soft underlay (training mat) with hygienic antiskid mat over the surface. In older children, the comfort could be improved by playing a CD with favourite fairy tales or music.

Which muscles are influenced by the exercise? Could the exercise influence salivation, enuresis, bad suction technique of breastfeeding etc.?

The therapy with the Vojta method influence all muscles in the body including the muscles of the tongue, oculomotor muscles and sphincters. The exercise normalises all stereotypical movements in every age.

Increased salivation is an impairment of the autonomic regulation of the swallowing of saliva. Physiologically, it appears in small children under about 3 months of age, so the ability to continuously swallow the produced saliva appears to prevent its spontaneous leaking from the mouth. In central coordination disorders in the first year of life, persisting spontaneous draining of the saliva often continues because of a disorder of the autonomic coordination of swallowing. Spontaneous draining of the saliva is a severe problem in mentally impaired people. With correctly lead exercise, correct autonomic swallowing of the saliva can be achieved in these patients. In adults, this problem may occur after a stroke, but a quality exercise regime can regain normal swallowing.

Enuresis of older children is complicated psychosomatic problem. The causes are difficult to determine. In some children, it is suitable to use VM2G exercises. An incorrect suction technique in children is caused by impairment of the sucking and swallowing reflex. Most often, it is related to central coordination and tonicity disorder. The exercise can quite quickly improve these simple stereotypes and allow the child to be breastfed without problems and later to be fed with more solid food. If the impairment persisted, the feeding would become stressful. Hunger forces the child to drink, but it often chokes due to its impaired stereotype. Swallowing of the more solid food becomes an even more pronounced problem. The disturbed stereotype of oculomotor muscles leads to various forms of childhood strabismus. Even this disorder could be well influenced by the exercise that normalises the tone of oculomotor muscles and their mutual coordination.

Is it necessary that the child is naked? Is it a problem to wear a diaper?

It is not necessary that the child is naked. It's no problem for him/her to wear a diaper.

Would it mean the exercise was incorrect, if the child didn't react during the exercise (didn't elevate the feet)? Eventually, the child doesn't react during the exercise, but it does during the following dressing.

I guess you are talking about the reaction with elevated feet during the exercise in supine position (reflex turning 1). The reaction on the stimulation is individual and depends on the condition of the disorder as well as the actual developmental phase. Muscle tone could be trained and the motor response to stimulation would be minimal. Anyway, consultation with experienced therapist would be necessary. He leads the treatment and would recognise if some change was required (e.g. adjustment of the position to get the feet out of support).

If the child doesn't mind the exercise at all (it doesn't cry from it), would it be worthwhile to exercise several more times?

It is suitable that the child doesn't cry during the therapy. If optimal conditions were created, the crying of the child would be minimal (refer to the answer to question no. 1). Repeating of the exercises should follow the chosen therapeutic approach, optimally 4 times a day in infants.

The child wriggles during the exercise – should it be straightened?

The exercises induce basic stereotypical movements – turning and crawling. They also contain a torsion component of motion. Thus, if it was induced, it would be physiological process. So that the torsion wouldn't be too strong and couldn't disturb the other motion components (bending, extension...), it is suitable to perform the exercise on a mat, that wouldn't allow the child to twist. Thus, it is better to exercise without a cloth or blanket placed underneath but rather on the sleeping pad or antiskid mat.

Eye contact should be held during the exercise, but the child turns the head in various directions. Do I have to follow the eyes of should I just talk to him and not worry about it?

Eye contact is very important. Nonverbal communication significantly helps the child to comprehend the actual situation. The turning of the head happens both spontaneously and thanks to reflex stimulation. It's not necessary to "follow" with the eyes. The child would "return" for the contact. And it is necessary to talk to the child throughout the whole time of stimulation, if possible.

One hand should be near the torso during the exercise. Should it be the whole limb or just the arm from shoulder to elbow?

I guess you mean the position of the upper limb during the reflex turning 1 (supine position). Basically, holding the arm lightly (from shoulder to elbow) near the body would be sufficient.

If we didn't manage to repeat all the exercises in one day, should we add some more to the next day?

Four exercises every day is optimal. If you didn't manage to meet the number of repetitions in one day for serious reasons, it better to continue normally in the following days. Excessive repetitions are not appropriate. It is important to optimise the time management so that the breaks in exercises would be as minimal as possible.

Is the sequence of the exercises important? Or it doesn't matter which exercise would be first and which would be the last? Should we train the left side first before the right one?

With respect to expectations of the child it is suitable to put the exercise in some order – the order between the periods of the day and during the training itself. It's necessary to follow the recommendations of the therapist that directs the exercise.

The fear of the Lord is the beginning of knowledge,
but fools despise wisdom and instruction. [Proverbs 1:7]

Annotation

The Vojta method of the 2nd generation with video compendium

The book is specifically focused on the Vojta method as the most developing treatment in physiotherapy. It approaches the readers with several examples, 3D computer animations, videos, photographs and anatomical drawings.

It is distinct from existing books on the Vojta method that have been written for experts as it is intended for parents.

It reflects the current development of the knowledge in neuroscience and biomechanics of the musculoskeletal apparatus and introduces the innovations in the Vojta method.

The author has addressed the practical application of Vojta method in children and adult patients for 25 years. The book contains the theoretical, diagnostic part of the musculoskeletal apparatus of the children and adults and the practical part concerning the therapeutic approaches. It shows other possibilities of the therapy through the use of technical aids.

The publication could serve as an expert textbook or as a popular-science handbook. It's been targeted to satisfy the needs of the therapeutic and medical public as well as the parents, who would appreciate this publication as comprehensive text reflecting the Vojta method.

Current Curriculum Vitae

Mgr. Václav Krucký

After graduating from his rehabilitative follow-on studies in 1995 at medical school in Plzeň, the author studied in the field of rehabilitation at the Faculty of Physical Education and Sports at Charles University in Prague concurrently with psychology at the Faculty of Arts of Charles University in Prague. In 1990, he attended lectures on the Vojta method under leadership of Dr. Václav Vojta.

After graduation in 1989, his specialised practice focusing on predominantly paediatric rehabilitation and physiotherapy began at several facilities in Prague. In the mid-nineties he worked for five years in outpatient departments and clinics in Bavaria. In Regensburg in 1994, he obtained the State Certificate for the specialty Physiotherapy for EU countries. He has gradually specialised in the application of the Vojta rehabilitative method both in children and adult patients. From 2001 through 2004, he worked as the Head of the Outpatient and Inpatient Rehabilitation Department of the Hospital in Ostrov nad Ohří. He has developed his teaching activities as an assistant at his alma mater FPES of Charles University at the medical school on Alšovo nábřeží in Prague and the higher vocational medical school in Karlovy Vary. Since 1992, he has carried his own rehabilitative and physiotherapeutic practice in Karlovy Vary and Prague. In 2003 he founded a non-profit organisation SVR – společnost pro vývojovou rehabilitaci o.p.s focused on support and development of innovative implementation of the Vojta method. Since 2016, he has developed the concept of the Vojta method of 2nd generation – VM2G.

Final Acknowledgements

At this point, I would like to express my deepest gratitude to my family, first of all, to my dear wife Jana and to our daughters, who have supported me through the years. I'm sure I wouldn't have managed to accomplish this without them!

My thanks surely go to the hundreds of patients and their close ones. They have showed great confidence, diligence and endurance during the therapy, which has often taken months up to several years. Particularly, I would like to thank the parents and patients for giving their consent to publish their stories, photos and videos.

From the bottom of my heart, I would like to express my gratitude to my numerous friends and colleagues, particularly to my assistant Hanka Kučerová for her extraordinary dedication. I would like to thank to my friend Dr. David Holub for his tireless supervisory comments that have helped me so much. My great appreciation goes to my friend of one year Roman Čiviš, who has helped me to view things from different perspectives. I'm grateful to Jan Babka for his help and many consultations – he has helped me to decipher the technical view of the mechanics of the human body.

I would also like to highlight the great work on the book provided by the graphic designers Vojtěch Pinc, Jana Tichá and Stáňa Karbušická. For superior photographs, I would like to thank to Jiří Hubatka and his wife Lída. The other unsuccessful and less successful pictures are my own.

The book represents the completion of 15 years of my theoretical and clinical work. I have collected the material, recorded videos, taken pictures of hundreds of patients. Nevertheless, this work wouldn't have achieved such results, particularly, their validation in a pilot study and confirmation of usefulness of the conception of home therapists without the support of Norwegian Funds.

I would like to believe that what has been formed and introduced to the world in this book will represent a worthy continuation of the work of the world-famous, prominent Czech physician Dr. Václav Vojta.

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Vocabulary

acetabulum – socket of the hip joint
acral parts of the limb – the endings of the limbs; outward from the wrist or ankle
adduction – pulling the limb towards the body
adnexa – appendages, accessory organs
aetiology – scientific discipline on the causes of the development and origin of diseases
afferent – leading of the neural impulses towards the brain
anteflexion – bending forward
apedal form – not walking
apoptosis – programmed death of a cell
asthenic – sickly, weak, languid (habit of a person)
ataxia, ataxic motor skills – impairment of the coordination of the movement of the body
atrophy – reduction, weakening, thinning of a previously normally developed organ, tissue or cell
aversive reaction – reluctance or resistance to something or someone
axial organ – common designation for spine and the skeleton of the chest, i.e. sternum and ribs
axial rotation – rotation around one's own axis

ballistic movements – stereotypical involuntary movements with wide extent caused by jerks of root muscles of the extremities with rotatory component
biocybernetics – science studying general principles of the regulation and transmission of the information within living organisms
biomechanics – part of the mechanics studying the mechanical characteristics of biological objects at all levels
bipedal gait – the ability of unaided walking on two feet
brachial paresis – palsy of an arm
brachial plexus – neural plexus innervating the arm

cardiopulmonary functions – functions of the heart and the lungs
caudal – lower; concerning the inferior parts of the body
cell migration – active locomotion of the cells within a multicellular body
central coordination disorder (CCD) – insufficiency, imperfection, abnormity or deviation from normal or ideal movement expressions, respectively, in the earliest stages of the development of the new-borns and infants
cerebellar – concerning the cerebellum
cerebellar disorder – impairment of the function of the cerebellum
cervicothoracic transition – the place of transition from cervical to thoracic spine
cluster – slump, grapes, bunch; a group of two or more objects
concentric – of or concerning circles sharing the same centre
cortical dysplasia – impairment of the

development and growth of the cerebral cortex
cranial – concerning the head
craniocervical transition – connection of the cervical spine to head

dental occlusion – bite; constriction of the jaws that puts the teeth into contact
dermatome – well-bordered skin area innervated by certain spinal nerve
desaxation – misalignment of the axes
diparesis – palsy of the lower limbs
disc herniation – prolapse of the intervertebral discs
disfiguration – deviation from the correct position, e.g. joints are not in an ideal posture
distal localisation – situated at the distant end, localised at the opposite to the inception
dorsal – in the back
dyadic interaction – mental relations, social communication and interaction between two individuals
dynamic stability of the centre of gravity – securing the centre of gravity (of the body or extremities) under changing conditions of motion
dyskinesia – disorder of the coordination of the normal movements
dystonic locomotion – movement impairment developed based on the incorrect muscle tone, abnormal contraction of a certain muscle or a group of muscles that causes involuntary movements or abnormal position of a certain part of the body

eccentric – situated outside the centre, distant from the centre, extravagant
embryogenesis – development of an embryo from the stage of embryoblast until the completion of organogenesis
entropy – the extent of uncertainty of an accidental process, the extent of disorderliness

flection – concerning bending
fluid – liquid, flowing, based on streaming, unsteady
forced exhale – stronger exhalation, marked with great effort
fractal – irregular geometric object that can be dissected into parts, which represent a copy of the whole, albeit reduced in size
frontal – head-on; describes a plane running through the body parallel to the front that divides the body into the anterior and posterior parts

genua valga – abnormal X-shaped curvature of the lower extremities
genua vara – abnormal 0-shaped curvature of the lower extremities
gyrification – organisation of the brain surface to gyri

habituation – getting used to; to naturalise; acceptance; the opposite to sensitisation
habitus – general outlook; the appearance typical for certain type of a person or certain diseases
hereditary preconditions – disease that could be inherited; innate disease
holokinetic motor skills – primitive uncoordinated movements of a new-born or an infant concerning the whole body
hyperkyphosis – excessive pathological backward bending of the spinal curvature, usually of the thoracic spine
hyperlordosis – excessive pathological forward bending of the spinal curvature, usually of the lumbar and thoracic spine

hypermobility – excessive, pathological extent of the movement in a joint; increased mobility
hypertonia – excessive, pathologically increased muscle tone
hypomobility – reduced mobility; decreased ability to move
hypoplasia – incomplete development of some organ
hypotonia – excessive, pathologically decreased muscle tone
hypotrophy – restricted growth of an organ or tissue

ideal motor skills; motor ideation – the ability to perform a movement only within one's own mind
infantile diparesis – palsy of the lower extremities in childhood
infantile hemiparesis – palsy of one half of the body in childhood
intrauterine – in the uterus
involutional – naturally aging; worsening; ceasing, perishing; regressive
irritation – stimulation; excitability
ischemia of muscle fibres – reduced, insufficient blood perfusion of the muscle fibres
isometric – having the same length; contraction of a muscle during the exercise, i.e. implementing the muscular force without apparent movement
isotonic – having the same tension or tone; contraction of a muscle leading to its shortening

kinaesthesia – set of perceptions that enable the perception of motion of the organs by stimulation of their receptors in muscles, tendons, periosteum and joint capsules
kinematic – moving; concerning movement
kinesiology – science of motion
kyphotisation of the spine – curving of the spine

locomotion – ability and skill of movement; movement in the space from one place to another because of personal muscular action
luxation – dislocation of a joint

malnutrition – insufficient nutrition
medial localisation – localisation near the medial axis
morphology – science of shapes, forms and structure of the organism
motor activity – actions concerning movement
motor intelligence – the ability to use mental skills to coordinate bodily movements
muscle rigidity – stiffness of the muscles; inflexibility
muscle tone – muscle tension
myelination – creation and development of myelin sheaths around neurons
myoskeletal – concerning muscles and bones

neural alienation – disaffection; inability to perceive and use motor skills of individual body parts
neural inhibition – slowing of nervous actions
neural lesions – damage to the nerves
neural plasticity – the ability to create neural cells and their connections anew
neuronal differentiation – biological process concerning the differentiation of the neural cells into individual subtypes

ontogenesis – individual development of an individual from the embryonic phase to extinction

opisthotonus – position of the body with arched bending backward due to spasm of the muscles of the back
orofacial – concerning the mouth and face
ossification of an impairment – unchangeable state of the impairment

pachygyria – excessive enlargement of the cerebral gyri
paraesthesia – uncomfortable abnormal subjective sensation within the skin, muscles, e.g. pins and needles, burning, itching
paresis – partial loss of motion, incomplete palsy
paretic – partially paralysed
patellar reflex – reflex of knee-cap
perception of body scheme – ability to adequately perceive and identify individual parts of the body and the whole body in static or dynamic situation
perineal nerves – nerves of the pelvic floor and perineum
phasic muscles – muscles that bear the moving function predominantly
phatic functions – functions concerning speech, ability to name an object and to comprehend speech
phonation – the ability to vocalise
plegia – suffix denoting palsy; paralysis; complete loss of ability of motion
polymorphous problems – multiform and numerous difficulties
polytrauma – infliction of two or more organ systems
postural autonomic regulation – ability of active provision of any position of the body or its segments based on autonomic regulation of the muscle activity
postural reactivity – the ability to implement active stabilising function generated during every movement of the segment
praxia – skilfulness, handiness
predilection in the posture of the head – forced, pathological posture of the head
primitive reflex – basic innate neurological reflexes of the infants
proliferation – growth, creation and development of a foetus
proprioception – perception and acquisition of the impulses on the position of the body
protracted development – lengthy and lingering development that lasts longer than usual
protraction – retardation, delay
proximal localisation – nearer to the centre; nearer to the torso or the head
psychosocial – related to life among people
punctum fixum – point of support
punctum mobile – point of motion

quadriparesis – palsy of all four limbs
quadrupedal gait – movement on all four limbs

retrogenia – remarkably receding mandible
reversible – able to return; to repeat the development
root joints – shoulder and hip joints

sagittal axis – parallel to medial plane of the body; anteroposterior
sciatic nerve – major nerve running through the back of the thigh
self-remediation mechanism – healing oneself by one's own possibilities, strengths, processes, resources and mechanisms
sensorimotor – a set of processes that combine the sensory and motor features

separation anxiety – archetypal fear of separation from the mother or parents, respectively
spastic gait – gait disturbed by high muscle tension and impaired muscle coordination
spasticity – increased tension of muscles in the internal organs and the skeletal muscles particularly
standing upright – placing into a standing position, righting
stereognosis – ability to identify an object by touch only
strabismus – squint
subluxation – partial dislocation of a joint
supination – rotation in the forearm; the arm is bent at the elbow, palm is turned upwards and the back is turned downwards
symphysis – fibrous connection of the pubic bones
synaptogenesis – creation of the synapses, neural connections
synkinesis – combined movement
tarsal bones – bones of the foot between tibia and metatarsi
telereceptors – remote receptors (visual, auditory, olfactory)
thoracolumbar transition – place of connection of the thoracic and the lumbar spine
torpid – persistent, immune, resistant to therapy
torsional movements – wiggly, tortuous movements
transverse – crosswise
trophic – concerning nutrition, growth

ulnar deviation – deviated posture of the hand and fingers from the medial position towards the edge of the hand

ventral – abdominal, anterior
vital functions – basic life functions

The Vojta method of the 2nd generation
with video compendium

Václav Krucký

Cover Vojtěch Pinc
Graphic design Vojtěch Pinc, Petr Szelong
Layout Vojtěch Pinc, Petr Szelong
Ilustration Jana Jandáčková, Vojtěch Pinc, Stanislava Karbušická,
Kateřina Kuchařová, Michaela Klihavcová, Jiří Ščupal
3D models and Animation Vojtěch Pinc, Jiří Ščupal
Photography Jiří Hubatka

O.A.M.D.G.

Published by SVR – společnost pro vývojovou rehabilitaci
Dvořákova 468
36301 Ostrov
www.svr-reha.eu
www.rehabilitace.org
www.rehabilitacedodomu.cz

Printed by Tiskárny Havlíčkův Brod, a.s.
Husova ulice 1881
580 01 Havlíčkův Brod

ISBN 978-80-906760-4-6