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BASIC PRINCIPLES OF THE NEURODEVELOPMENTAL TREATMENT

OSNOVE NEURORAZVOJNOG TRETMANA

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ABSTRACT

There are an estimated 15 million people with cerebral palsy around the world, more than half of whom are mentally retarded while one third has epilepsy. It seems unlikely that there ever will be a drug that will undo the results of the damage to nerve cells or the death of masses of them, therefore, the treatment of neurological disorders will always be in the hands of physiotherapists, occupational therapists and speech therapists. The aim of the treatment for children with disabilities due to brain damage is to prepare and guide them towards their greatest possible independence and to prepare them for as normal adolescences and adult lives as can be achieved. The concept of neuro-developmental treatment (NDT) was evolved empirically by Bertha Bobath and Karel Bobath. They tried to find its theoretical explanations. NDT is a holistic approach dealing with the quality of patterns of coordination and not only with the problems of individual muscle function. It involves the whole person, not only his sensory-motor problems but also problems of development, perceptual-cognitive impairment, emotional, social and functional problems of the daily life as well.

This treatment approach makes it possible for occupational and speech therapists each to play an important part in the team, as well as parent participation in education and guidance. The characteristic syndromes of cerebral palsy are the result of abnormal sensory-motor development and appear gradually. If we start to treat the child in the period when abnormal patterns of posture and movement are already fully established and habitual, we can achieve only limited results and we cannot avoid deformities and orthopaedic surgical interventions. Early NDT treatment is considered to be the treatment that starts at the age of two to three months (corrected age), that is before anti-gravity voluntary movements emerge and abnormal movement patterns begin to be predominant. With early treatment we have the chance to integrate active normal sensory-motor experiences before abnormal movement patterns have become a habit. NDT is in practice a successful approach but we should not think that we can cure a brain lesion or cerebral palsy, or that we can change all cases to only "minimal" cerebral palsy. If the treatment is started before the abnormal patterns of movement have become established, we can help the child to organise his potential abilities in what for him is the most normal way.

KEY WORDS: Cerebral Palsy, Neuro-developmental Treatment

SAŽETAK

Procjenjuje se da u svijetu ima 15 milijuna ljudi s cerebralnom paralizom. Od toga je više od polovice umno zaostalo, a jedna trećina ima epilepsiju. Malo je vjerojatno da će ikad biti moguće medikamentozno liječenje oštećenih ili uništenih živčanih stanica, pa će stoga (tretman) liječenje neuroloških poremećaja uvijek biti u nadležnosti fizioterapeuta, radnog terapeuta i logopeda. Cilj je liječenja djece s oštećenjem mozga i posljedičnim poteškoćama priprema i vođenje do najveće moguće samostalnosti (neovisnosti) te priprema za čim normalniji život u mladosti i odrasloj dobi. Koncept neurorazvojnog tretmana (NRT) empirijski su osmislili Bertha Bobath i Karel Bobath i pokušali mu naći teoretsko objašnjenje. NRT je cjelovit pristup koji vodi računa o idealnoj koordinaciji, a ne samo o problemima pojedinačnih mišićnih funkcija. Obuhvaća cijelu osobu, ne samo senzorno-motorne probleme već i razvojne probleme, perceptivno-kognitivne poremećaje, emocionalne, socijalne i funkcionalne probleme svakodnevnog života.

Ovakav pristup tretmanu omogućuje radnom terapeutu i logopedu važnu ulogu u timu, kao i sudjelovanje roditelja u odgoju i vođenju.

Karakteristični sindromi cerebralne paralize rezultat su nenormalnog senzo-motornog razvoja i pojavljuju se postupno. Ako počnemo liječiti dijete s već potpuno izraženim poremećajem stajanja i kretanja, postići ćemo tek ograničene rezultate i nećemo moći izbjeći deformitete i operativne ortopedske intervencije.

Rani NRT znakovi početak su liječenja između drugog i trećeg mjeseca života (uz korekciju za gestacijsku dob), dakle prije pojave vanjskih antigravitacijskih pokreta i prije nego slika abnormalnih pokreta počne prevladavati. Ranim tretmanom postoji mogućnost uključivanja normalnih senzomotornih iskustava prije nego što abnormalni pokreti postanu dominantni. NRT je uspješan pristup, ali ne smijemo misliti da možemo izliječiti oštećenje mozga ili cerebralnu paralizu, kao što ne možemo sve slučajeve dovesti do "minimalne" cerebralne paralize.

Ako je liječenje započelo prije uspostavljanja abnormalne slike pokreta, možemo djetetu pomoći da organizira svoje potencijalne sposobnosti na, za njega, najbolji mogući način.

KLJUČNE RIJEČI: cerebralna paraliza, neurorazvojni tretman

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DEFINITION

Cerebral palsy is an umbrella term covering a group of non-progressive, but often changing, motor impairment syndromes secondary to lesions or anomalies of the brain arising in the early stages of its development (Mutch L at al, 1992)

THE DIMENSIONS OF THE PROBLEM

There are an estimated 15 million people with cerebral palsy around the world, more then half of whom are mentally retarded and one third have epilepsy.

It seems unlikely that there ever will be a drug that will undo the results of the damage or the death of masses of nerve cells and therefore the treatment of neurological disorders will always be in the hands of physiotherapists, occupational therapists and speech therapists (Nathan, 1990). With modern technology – especially brain imaging, we are able to identify brain lesions but we do not as yet know enough about the abilities and potentials of the developing brain in order to be able to compensate for and adapt to the injury.

The aim of the treatment for children with disabilities due to brain damage is to prepare and guide them towards their greatest possible independence and to prepare them for as a normal adolescences and adult lives as can be achieved (Bobath, 1984).

The concept of neuro-developmental treatment (NDT) has been evolved empirically by Mrs. Bertha Bobath from 1942 onwards. By careful clinical observation of adults with hemiplegia and of children with cerebral palsy, she studied their reactions to being handled. Dr. Karel Bobath, her husband and a neurologist, tried to find the theoretical explanations by studying current neurophysiological literature (Köng, 1991).

1. Rationale

NDT is a holistic approach dealing with the quality of patterns of coordination and not only with the problems of individual muscle function. It involves the whole person, not only his sensory-motor problems but also problems of development, perceptual-cognitive impairment, emotional, social and functional problems of the daily life as well (Bobath, 1990).

The concept of NDT is based upon the recognition of the following facts:

- A brain lesion results in the appearance of stereotyped abnormally coordinated
- movement patterns, which will abnormally affect a great number of muscle groups in extensor and/or flexor synergies. In the beginning these abnormal patterns are changeable but as time goes on, they may increase with stimulation, effort and stress. Tonic postural activity (particularly associated reactions) reinforces the abnormal movement patterns which contribute to the development of contractures and deformities.

A brain lesion interferes with the development of normal postural control in relation to gravity:

- instead of normal postural tone, we find abnormal tone: too high (spasticity), too low (hypotonicity) or fluctuating (athetosis);
- instead of normal reciprocal interaction, we find excessive co-contraction, or sudden inhibition of antagonists resulting in the lack of ability to make a graduated movement;
- instead of normal automatic movement patterns of righting, equilibrium and protective reactions, we find a few static and stereotyped postural patterns of tonic reflexes.

The abnormal sensory-motor development interferes with the child's whole development (sensory, perceptual-cognitive, psychological). Associated sensory and/or perceptual deficits can be primary (due to brain damage) but frequently they are secondary to the physical disability, which prevents the child from exploring himself the environment. He does not develop the same concept of his body, as does a normal child.

Abnormal sensory-motor experiences will result in an abnormal body awareness and abnormal body image, which can be reinforced by parents' inexperience and inability to deal with their child's disability (Bobath, 1984; Köng, 1986; Quinton, 1986; Bobath, 1990).

2. Evolution of the NDT concept and its application

In 1942, while she was handling a patient with hemiplegia, Mrs. Bobath discovered that by preventing him from moving into an abnormal pattern of activity by his spasticity, a more normal movement and a more normal functional activity became possible for the patient through her handling (Köng, 1991; Rohlfs, 1999).

By observing the patient's reactions to her handling she became aware of three important facts:

- it is impossible to superimpose normal movement patterns on abnormal ones, the abnormal patterns need to be suppressed (inhibited)
- the importance of sensory-motor experience – we do not learn a movement but the "sensation of movement"
- by moving the proximal part of the body it is possible to influence and to change the movements of the distal parts.

Mrs. Bobath was influenced by the work of Knott, Kabat and Voss and recognised the importance of proprioceptive stimulation to build up tone in patients with low and unstable postural tone. From Rood and Goff she learned of the importance of tactile stimulation in order to obtain movements of hands, feet, mouth and tongue (Bobath, 1984; 1990, Köng 1991).

2.1. Inhibitory control

"Reflex inhibiting postures" (R.I.P.)

Influenced by animal experiments of Sherrington and Magnus who found out that identical stimulus in different positions elicited different reactions, i.e. different movement patterns, she placed and held the patient in "reflex inhibiting postures" to break up the abnormal postural and movement patterns. First she used a pattern opposite to the patient's total pattern, which she modified later into an individually adapted mixed pattern of a better-coordinated flexion and extension. Active adaptation of the child being held in R.I.P. resulted in a change of activity of the whole body due to the normalisation of postural tone. The child was held in a series of postures, which controlled his whole body. Unfortunately, except in a few very young children, no spontaneous carry over into movement and function occurred, as the child had never previously experienced the sensation of normal movements. This made normal active and spontaneous movements impossible. The treatment was too static and was not continued in this way (Bobath, 1984; Köng, 1991; Mayston, 1992).

The concept of inhibition remained except that its application was changed later on. Inhibition is the process of intervention that reduces dysfunctional muscle tone. It breaks up the abnormal excessive flexion or extension (Bobath, 1984; Quinton, 1986; Boehme, 1988).

The concept of stimulation of low tone was developed gradually and the dangers of each were recognised (Bobath, 1984).

2.2. Inhibition combined with stimulation and facilitation

After preparing and obtaining a more normal postural tone the patient needs to learn to move in many different combinations of more normal movement patterns. Mrs. Bobath looked for possibilities of how to transmit to the patient in order to enable them to experience normal sensations of functional movements they had either lost or never developed. Only by feeling a near normal active movement with minimal effort can the patient learn how to perform it. The therapist's task is to make this possible.

Then the Bobaths recognised the importance of postural reactions (righting and equilibrium reactions) from the work of Magnus, Peiper, Weisz and Zador. The various postural reactions are coordinated in definite patterns, which are common to all of us.

Although they occur automatically they are active movements. All voluntary and skilled functional activity with its complex and selective patterns of coordination is performed on the basis of automatic postural reactions. The motor patterns of normal postural reactions develop in the child gradually during the first few years of life (Weisz, 1938; Zador, 1938; Peiper, 1963; Bobath, 1990).

The Bobaths realised the importance of understanding normal development in order to be able to understand abnormal development and how to treat it. A good working knowledge of normal and abnormal development, and an awareness of their effect on the developing body image is one of the most important professional qualities of a NDT therapist (Quinton, 1997).

The Bobaths recognised that during normal development, in the beginning there is the influence of tonic reflexes which later disappear and are suppressed by the development of righting reactions. These are later overlapped and integrated into balance reactions and voluntary movements. This knowledge helped them toward a more dynamic treatment - the facilitation of sequences of righting reactions, equilibrium reactions, supporting reactions and other automatic reactions (Köng, 1991).

2.3. Dynamic treatment with control from key points

Mrs. Bobath found a way of using "key points of control" (body parts, mainly proximal - head, shoulders, pelvis) from which abnormal patterns could be controlled (inhibited), and the strength and distribution of postural tone could be influenced while at the same time normal movement patterns could be facilitated or a specific technique of stimulation could be used. From the key point of control the therapist is able to control and guide the movement of the whole body. The child could be facilitated to react actively where not actually held or controlled (Bobath, 1984).

Facilitation is the process of intervention, which uses the improved postural tone in a goal-directed activity. The patient is active and the therapist is guiding and controlling the activity. Facilitation makes movement easier but in the treatment it also means "making it possible" and "making it have to happen". The therapist should make movements easy for the child, enjoyable and safe, so that he likes to move and feels an urge to do

so (Bobath, 1964; Bryce, 1972; Boehme, 1988; Bly and Whiteside, 1997; Rohlfs, 1999).

Inhibitory control is used with facilitation. It is accomplished simultaneously with the least amount of physical intrusion. As the therapist uses techniques that reduce the dysfunctional tone, the patient makes more efficient movement adaptations. This happens spontaneously because the patient is actively involved in functional movement and automatic postural reactions while the therapist is handling him. The treatment is done by "handling" and based on the close interplay between the patient and the therapist. The therapist is guided by the patient's reaction to his handling (Bobath, 1984; Boehme, 1988).

One of the greatest problems in the treatment of children with cerebral palsy is to obtain good balance reactions. It has a detrimental effect on movement when they are insufficient or absent. It is easier to obtain them if we start the treatment early because we are able to follow the normal developmental overlap of righting by the equilibrium reactions (Bobath, 1984).

The treatment should not follow rigidly the developmental milestones. In normal development children develop many activities simultaneously. There is a big variability and inconsistency in normal development (Touwen, 1978). Normal basic movement patterns which belong together at any developmental level should be transmitted through repetition to the child and enable him to perform various different activities (Bobath, 1984; Köng, 1992; Quinton, 1997).

During the treatment it is necessary to reduce the therapist's control, handing it over gradually to the child and allowing him the control of his own movements. Much guided control and repetition of the required reactions may be necessary to assure their quality (Bobath, 1984; Quinton, 1997).

2.4.Treatment in functional situation

Not all movements obtained through treatment are spontaneously carried over into the activities of daily life. There is a need for a direct transition of treatment to functional skills, which is the only way to influence also the quality of prehension and manipulation. The treatment incorporates systematic preparation to improve specific functions in the present and to prepare specific functions needed in the near future. Such an approach demands a thorough analysis of each task to be prepared for the child to perform, which should be related to the assessment of the needs of the individual child, finding out what interferes with or what is missing from each part of the task, looking chiefly at the quality and not just the quantity of the child's performance. The treatment in functional situations allows the child to repeat and experience normal movements in many different ways (Bobath, 1984; Mayston, 1992).

This treatment approach makes it possible for occupational and speech therapists each to play an important part in the team. Nancy Finnie and Helen Müller did this pioneer work respectively (Finnie, 1968; Müller, 1997).

Occupational therapy based on NDT concept can improve the quality of eyes/hand function, sensation and perception, which are each so essential in all functional activities (Finnie, 1968, 1997; Boehme, 1988; Köng, 1991).

A better postural control obtained through NDT influences the quality of breathing, phonation, eating and drinking, which are important factors in the development of comprehensible speech (Keller, 1997; Leeuwenburg-Grijseels, 1997; Meek, 1997; Mueller, 1999).

2.5. Parent participation, education and guidance

A child's development occurs within a permanent interaction with his environment, that is the mother in the beginning. She handles the child in a pattern of her social cultural environment and intuitively adapts her handling to the child's behaviour and developmental achievements (Papoušek and Papoušek, 1984). When there is a retarded or abnormal development she will intuitively adapt to protect her child (Bobath, 1967).

In treatment it is essential to establish adequate mutual child-mother reciprocity, interaction and communication, and a mutual mother-therapist relationship. Guiding and training the parents in home management is of the greatest importance (Finnie, 1968, 1997; Bobath, 1984). No amount of treatment can be effective unless the progress, which the child makes during the treatment, is carried over into his everyday life and activities.

With the cooperation of parents and teachers there is a better chance of obtaining a carry over of a more normal movement into everyday activities and thus avoid frustration and overloading of the child and parents with treatment. We have to respect the situation of the family and their individual abilities. We practise with them so that they can feel and learn how to continue a treatment programme at home and how to handle the child in order to help him with his own movements during the day. We have to help them to understand why their child cannot perform some movements. They have to understand the child's problems and possibilities to solve them and what they can do to help. Parent train-

ing takes time, is difficult and needs good communication between the therapist and the parents.

2.6. Team approach

The child's whole development depends largely on his ability to move and explore his environment. All his problems are related and in order to understand them an overall approach is needed. Everyone concerned with the child's treatment and management should work closely together and have the same understanding of what is being done and of its aim. It should be a common effort rather than each one working in isolation.

2.7. The NDT concept today

The basic principles of NDT remain the same. By the inhibitory control of abnormal movement patterns and simultaneous facilitation of automatic postural reactions (righting and equilibrium reactions) with the therapist's hands combined with different techniques of stimulation, we reduce the dysfunctional abnormal postural tone to facilitate and transmit to the child a variety of sensory-motor experiences in functional and goal directed activities.

The therapist controls proximal key points of control (head, shoulders, trunk, pelvis) to achieve a good for each child individually adapted, a mobile control of the posture.

In the early treatment we can facilitate righting and equilibrium reactions close to the sequences of normal development. In an older child we have to compromise, and find and transmit the essential basic patterns, which are needed to improve the child's activities in the present and near future.

The treatment is, therefore, adapted to the needs of the individual child. The child's abilities and disabilities are carefully assessed and the child is handled and treated in a specialised way, observing and controlling his responses. There is a necessity for a constant interaction with assessment and reassessment during the treatment (Bobath, 1987; Mayston, 1992).

3. Early treatment based on NDT principles

The characteristic syndromes of cerebral palsy are the result of abnormal sensory-motor development and appear gradually. If we start to treat a child in the period when abnormal patterns of posture and movement are already fully established and habitual, we can achieve only limited results and we cannot avoid deformities and orthopaedic surgical interventions (Köng, 1974; Hochleitner, 1977; 1986; Köng, 1990).

Elizabeth Köng, paediatrician in Switzerland, did the pioneer work in the field of early detection and early treatment. Inspired by the idea of the Irish therapist Eirene Collis, who first recognised the need for early detection and treatment, and supported by new advances in developmental and child neurology, she recognised the advantages and importance of the NDT-Bobath concept as an appropriate approach to early treatment (Köng, 1965; Köng, 1966; Bobath, 1967; Köng, 1982; Scherzer, Tscharnuter, 1982; Köng, 1999).

The English physiotherapist Mary Quinton, working side by side with Elizabeth Köng in Bern, adapted and further developed the techniques for early treatment of babies based on the NDT-Bobath concept (Quinton, 1986; 1997).

There are many infants who show apparently abnormal motor behaviour during the first months of life. Most of them overcome it spontaneously. Substantial improvement in obstetrics and perinatal care during the last decades have resulted in a decrease in perinatal mortality, in a significant change of panorama of cerebral palsy and in an increase in the number of surviving neonates at risk of developmental disorders. It is of great importance that these babies are longitudinally followed and checked by experienced paediatricians not only during the first months but during the whole first year of life (Köng, 1966; 1990).

The observation and evaluation of the quality of an infant's spontaneous motor behaviour introduced by Heinz Prechtl, has become the most reliable diagnostic tool in detecting potential cerebral palsy (Prechtl, 1997; Prechtl at all, 1997). The age of three months (corrected in preterm infants) has proved to be a stage from which early abnormal signs may either be disappearing or increasing. A growing dominance of abnormal movement patterns from the third month onward is an absolute indication for NDT. If abnormal spontaneous general movements are accompanied by abnormal sucking-swallowing and/or visual problems, we have to introduce NDT earlier on (Köng, 1990).

Early NDT is considered to be the treatment which starts before or at the age of two to three months (corrected age), that is in the period of fidgety character of general movements before anti-gravity voluntary movements emerge. The functional aim of fidgety movements is probably the calibration of the proprioceptive system (Prechtl, personal communication). In the fidgety period there is also a change from polineuronal to mononeuronal inervation (Purves, 1994; Gramsbergen, 1997). If fidgety movements are absent or of abnormal quality, it is a predictive sign of developmental disorder (Prechtl, 1997).

Not every baby treatment is early treatment. Early treatment is considered to be the treatment that starts as

soon as brain lesion as abnormal movement patterns are observed and begin to be predominant.

3.1. The importance, advantages and possibilities of early treatment

The sensory side of the sensory-motor experience and its influence on the body image

Standing, walking, prehension and manipulation in human infants require a certain level of postural control (Gramsbergen, Hadders-Algra, 1998). The normal baby gradually develops the dynamic chain of sequences of righting reactions and balance reactions in relation to gravity, the repetition of which lays down with increasing precision these finely integrated sensory-motor experiences. These in time become automatic and form the basis for the learning of future skills. The resulting body image that evolves from this variation of sensory-motor experiences will be normal. On the other hand the development of babies with brain dysfunction, the abnormal sensory-motor experiences with their resulting habit patterns and limited development of righting and balance reactions, will result in an abnormal body image and an inadequate sensory-motor base for the later learning of movement skills.

With the early treatment we have the chance to integrate active normal sensory-motor experiences before abnormal movement patterns have become a habit. These are the babies who without help only develop abnormally, their body image playing a large part in this process. This is where we can help (Quinton, 1986; 1997, Bly, 1999).

3.1.2. The importance of righting reactions and midline orientation

In the third month ("fidgety" period) there is an orientation to the midline head control in relation to the body (Prechtl, 1988) under the influence of righting reactions (head – body righting, active vertical midline), which enables the visual system to be integrated and interrelated into the postural control coupling of the visual system (Nelson, 1996; Quinton, 1997).

3.1.3. Competition of patterns in normal and abnormal development

These righting reactions (only evident when the neck is posteriorly lengthened and there is a chin-sternum tuck) will compete with tonic activities and Moro reflex, which thrust the neck and head into extension. This competition remains normal providing that postural tonic extensor activities are slowly but surely suppressed during the third to the fifth month of life so that the normal head control and midline symmetry may be established. If this does not occur, Moro reaction and postural tonic activity will become dominant and influence all future development in an abnormal way.

In the same way of competition, the asymmetric tonic neck reflex (ATNR) may start to become dominant. In early treatment by activating and repeating the dynamic sequences of righting reactions we have the possibility of laying down more normal pathways which will compete with and inhibit the otherwise continuing development of the abnormal. Of course, the outcome depends on the initial brain damage. If we can find and release the righting reactions, there is always hope for improvement (Quinton, 1997).

The importance of handling the baby and the baby-mother interaction in early treatment

One of the most common criticisms of NDT is that there is too much handling of too many hands on the child. It is natural that a baby during his first months of life is picked up, carried, put down, dressed, undressed and so on. There is a natural interplay between baby and mother, between her way of supporting a baby and his growing ability of "putting himself right" by righting and controlling the position of his head and trunk.

It seems improper to ask the mother to take her hands off her baby. To teach the mother special ways of handling her baby is the most important aspect of early

treatment. Only if she helps in this way can the baby acquire a variety of necessary sensory-motor patterns of postural adjustment. Repetition is so important. It has a dual effect not only upon his motor development but also upon the gradual formation of a more normal body image, which underlies his future development and learning of skills (Bobath, 1967; Quinton, 1986; 1997).

3.1.5. Prevention of contractures and deformities

Contractures and deformities are not present in the baby, except for possible congenital dislocation of one or both hips or congenital clubfoot not due to a brain lesion. There may be very early signs of threatening deformities such as shortening of neck extensors due to dominant tonic extensor activity or persistent asymmetry with shortening of one side of the trunk and pelvic obliquity because of the dominance of ATNR with a tendency to hip dislocation and scoliosis due to the dominance of abnormal patterns in competition with the normal ones. Early treatment can in most cases prevent the development of major contractures and deformities and frequent early orthopaedic surgical intervention in children with cerebral palsy.

3.2. The limits of the outcome of early treatment

Extensive brain lesion will limit the outcome of early treatment.

In babies with additional severe sensory loss, perceptual impairment, and severe mental retardation the treatment result is very limited. Children with severe proprioceptive and temporo-spatial perception problems perceive only to a small degree normal reactions transmitted through treatment. Their motor progress is slow. They need some additional specific perceptual training.

Severely mentally retarded children do not make spontaneous use in daily life of what they have experienced during treatment.

Children with hemiplegia will always continue to favour their better side even if their disabled side becomes mobile and automatic activities can be obtained.

If we cannot establish mutual cooperation with the family, for whatever reasons, the effect of early treatment may be reduced and limited (Köng, 1990).

3.3. Quality of treatment

Treatment results depend a great deal on the quality of treatment. Besides a good theoretical background, good working knowledge and professional skills of the therapist, there are some very important points that add to the quality of the treatment.

Therapy should be a mutual communication between the child and the therapist as a two-directional, positive experience of giving, receiving and responding to one another, coupled with anticipation and pleasure, always advancing together. The baby/child should always be respected. If he is getting what he needs, he will accept and follow. If something is always refused, there is a reason that needs to be explored and dealt with.

It is essential to obtain active automatic normal reactions in the treatment, to be able to prepare and to wait for these reactions, to adapt the treatment continuously to the momentary situation of the child and to withdraw control gradually so that the child can repeat and initiate by himself in order to be able to take over the control.

Careful challenge within the therapy is necessary to make a treatment interesting for the child. The child and his parents will refuse dull, monotonous and uninteresting treatment.

The adaptation of the therapy to the individual personality, interests and potentials of the child will contribute much to the motivation of the child. The involvement and realistic expectation of the therapist in obtaining improvements are an important motivation for parents. It is essential that the doctor and the therapist clearly explain to the parents the essence and aims of the treatment not just in words but also to encourage them to feel the movements they aim to transmit to the child on and within their own bodies, as well as to perform them on a doll. This way they will understand more fully what their baby or child requires (Quinton, 1986; Quinton 1997).

3.4. Duration of treatment

It is necessary to continue therapy until the desired result is secured, i.e. equilibrium reactions are obtained while standing and walking in order to free the hands for function.

Later on these children need a longitudinal follow-up because sometimes they deteriorate, especially during puberty, in the quality of their postural control with a tendency to develop a kyphotic or scoliotic deformity.

With a residual disability, even a slight one, it is worthwhile to continue treatment in a reasonable way until or into adulthood. Functional abilities and the quality of life will further improve. The amount of treatment should be individually adapted according to problems and priorities with strong emphasis on the child's control of its own movements (Köng, 1999).

CONCLUSION

Cerebral palsy is long-life, but improves with adequate intervention.

NDT is in practice a successful approach but we should not think that we can cure a brain lesion or cerebral palsy, or that we can change all cases to only "minimal" cerebral palsy. If the treatment is started before abnormal patterns of movement have become established, we can help the child to organise his potential abilities in what for him is the most normal way.

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