

HABILITATION TREATMENT OF HYPERTONIA IN NEWBORNS AND INFANTS

Ljiljana Lazić, Marija Spalević, Dragan Zlatanović, Anita Stanković and Olga Marinković

The quality of muscle tone of newborns and infants is an important parameter for the assessment of neurological maturation, i.e. for the detection of neurological abnormalities.

Changes in muscle tone are often perceived in the so-called "risk children", and could be a sign of a primary disorder of the central nervous system in terms of early brain damage. The change in muscle tone in terms of hypo- and hypertonia in the first months of life is considered a symptomatic risk for disturbances in motor development, and requires inclusion of the rehabilitation treatment, even though the normalization is often possible to occur spontaneously, without any therapy. The aim of this study was to examine the effects of habilitation treatment on reducing hypertonia in newborns and infants. The study includes 42 children of both genders, aged 0-12 months, who are habilitated due to the manifested symptomatic risk for disturbances in motor development, with elevated muscle tone. Muscle tone was measured through the use of "French angles" (tie sign, heel-ear manoeuvre, popliteal angle, leg abduction and dorsiflexion of the foot), both in the beginning and in the end of treatment. The results showed that in 32 children there was complete normalization of elevated tone by the end of the 6th month of age, in seven children by the end of the 10th month of age, while three children kept struggling with persistent hypertonia, but to a lesser degree than in the initial state. To conclude, the best effects of habilitation treatment to reduce the high tone can be expected in the first three months of life through the use of a very early habilitation. The later the start of the treatment, the smaller the odds for normalization, and much more effort needs to be invested in order to normalize the elevated muscle tone. *Acta Medica Medianae 2011;50(1):22-25.*

Key words: hypertonia, newborn, infant, treatment

Department of Physical Medicine, Rehabilitation and
Prosthetics, Clinical Center Niš, Serbia

Contact: Ljiljana Lazić
Clinic of Physical Medicine, Rehabilitation and Prosthetics
Clinical Center Niš
Bul. Zorana Đinđića 48, 18 000 Niš
E-mail: draganzlatanovic1@gmail.com

Introduction

Detected or undetected events before, during or after birth may increase the possibility for developmental abnormalities to occur in motoric development of a child. Those are the so-called risk factors for developmental abnormalities, and the most common are: risky pregnancy, labor complications, low weight, prematurity and others (1).

One of the most important parameter for assessing the neurological maturity, that is, for detecting neurological abnormalities is the muscle tone, which can be altered - lowered or elevated. Muscle tone alterations are often seen

in the so-called "risky children" (children who have one or more risk factors for developmental abnormalities in their medical history), and they can be an indication of a primary disorder of the central nervous system (CNS) in terms of an early brain damage (2). The changed muscle tone in terms of hypotonia and hypertonia is considered to be a symptomatic risk and it requires the habilitation treatment, even though the spontaneous normalization is often possible.

Different techniques and methods are used for muscle tone normalization. The ones used more often are: Vojta's method, which is based on a reflex movement forward - reflex of creeping and turning; and Bobath's method which is based on inhibiting pathological and facilitating normal postural mechanisms (3).

Aim

The goal of this study was to examine the effects the habilitation treatment has on hypertonia reduction in newborns and infants.

Material and methods

The study included 42 children of both genders, aged 0-12 months, who were habilitated due to the elevated muscle tone.

Muscle tone was evaluated by measuring the French angles:

1. Tie sign
2. "Heel-ear" maneuver
3. Popliteal angle
4. Leg abduction
5. Dorsiflexion of the foot

Table 1: Normal values of the French angles for certain age groups (by David, 1992) (4)

French angle	0-3 months	3-6 months	6-9 months	9-18 months
Tie sign	0-15°	15-45°	45-60°	60 -85°
Heel-ear	100-90°	90-60°	60-40°	40-10°
Popliteal angle	80-90°	90-110°	110-150°	150-170°
Leg abduction	40-70°	70-100°	100-130°	130-150°
Dorsiflexion	40-80°	40-70°	40-70°	40-70°

The angles were measured at the beginning, during (every 30 days) and at the end of the treatment. The results were identified like this: eutonia (if the value of the angle corresponds to the value given in Table 1) and hypertonia (if the value of the angle is lower or higher than the value given in Table 2).

Distribution of the elevated muscle tone was also analyzed, and the results were qualified like this:

- Generalized (global) hypertonia
- Isolated (partial) hypertonia of the neck and torso (extensors)
- Isolated hypertonia of the extremities (only upper, only lower or both).

Different methods of habilitation were used for normalizing elevated muscle tone. They were selected to suit the individual needs of a child. Most commonly used methods are Vojta's and Bobath's in combination with other techniques and physical procedures (paraffin and the like). Treatment lasted eight weeks on average; it was conducted five times a week for 30 minutes. Educated parents implemented the treatment at home.

These are the parameters that were analyzed and monitored:

1. Gender and age
2. Distribution of hypertonia
3. Therapeutic effects in relation to age and
4. The ultimate effect of the treatment.

Results

The study included 42 children in total, 22 boys and 20 girls. Their age is shown in Table 2. The table shows that the vast majority of children

were diagnosed with hypertonia between 0 and 6 months. This is the result of the continuous monitoring of the development of the children who are at risk according to their medical history. Monitoring was carried out systematically, and the first physical examination had been conducted in the maternity ward (76%). The remaining 24% belongs to a group of children who were not included in the systematic monitoring of development, and they arrived late for the first examination and treatment (children outside the city area or from distant places of residence).

Table 2 shows distribution of hypertonia, and it is evident that the most common diagnosis was generalized hypertonia (45%), as well as hypertonia of the neck and torso (33%), while hypertonia of the extremities was registered in 12% of the children.

Table 3 shows therapeutic effects of habilitation in relation to the age of the children. All the children under three months of age experienced complete normalization of the elevated muscle tone to the extent of eutonia.

In the group 3-6 months, complete normalization was achieved in 12 children, in two there was an improvement with a dissent of 5°, measured by French angles. In these children, too, there was a correction of the muscle tone by the end of the 10th month of life.

In the group 6-9 months, complete normalization was achieved in two children, improvement (dissent less than 5°) in 4, and there was no effect in one child (dissent higher than 5°).

One of the three children from the group 9-12 months experienced improvement. There was no effect in other two and they remained on therapy because of the central disorder of coordination.

Graph 1 shows the final effect of the treatment. Complete normalization of the elevated muscle tone was achieved in 32 children (76%), improvement (dissent in angles less than 5°) in seven children (17%), and there was no effect in three children (7%). Of all the children who experienced complete muscle tone correction, 30 were less than 6 months old, and two were 6-9 months old.

Table 2. Age

Age	Number	%
0-3 months	18	43
3-6 months	14	33
6-9 months	7	17
9-12 months	3	7

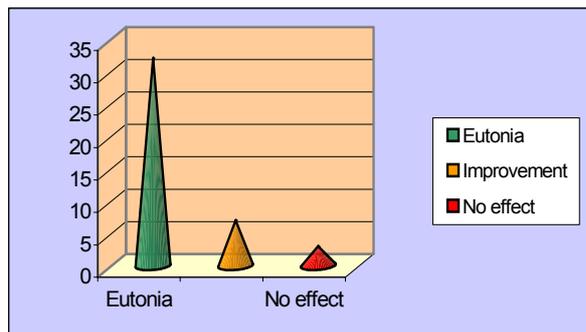
Table 3. Distribution of hypertonia

Distribution	Global	Neck and torso	UE	LE	UE and LE
Number	19	14	2	3	4
%	45	33	5	7	10

UE - upper extremities
LE - lower extremities

Table 4. Therapeutic effects of habilitation in relation to age

Muscle tone quality	0-3 months Number	3-6 months Number	6-9 months Number	9-12 months Number
Complete normalization (eutonia)	18	12	2	0
Improvement (dissent less than 5°)	0	2	4	1
No effect (dissent higher than 5°).	0	0	1	2



Graph 1. The final effect of treatment

Discussion

Muscle tone is regulated by a motor neuron in the spinal cord, and it is normal when there is a balance between two competitive forces that affect the muscle tone.

Those forces are:

- Excitatory impulses are generated in the muscle spindle and Golgi tendon organ, then enter the spinal cord through the afferent neuron and release excitatory neurotransmitters such as glutamate and aspartate.

- Inhibitory impulses arise in the basal ganglia, brain stem and cerebellum, then go down to the spinal cord and release the inhibitory neurotransmitter - γ -aminobutyric acid (GABA) from interneurons, which then connects to the α motor neuron.

In cerebral palsy, the part of the brain that produces descending inhibitory impulses is damaged, resulting in the relative "excess" of excitatory impulses and increase in muscle tone (5).

Spasticity is a type of muscle hypertonicity characterized by rapid increase in resistance to passive stretching of the muscles. Spasticity more often attacks the lower in relation to the upper limbs. It also more often attacks the flexors, adductors and internal rotators than their antagonists. About 60 - 70 % of children who suffer from cerebral palsy also suffer from spasticity, and usually in combination with some other disorder - chorea, athetosis, dystonia. It is

difficult to set a definitive diagnosis of cerebral palsy with newborns and infants, because the fixation of pathological motor patterns has not occurred yet (6). At that time, changes of the muscle tone can be observed in the form of hypertonia, or even hypotonia, which would later evolve into spasticity. Therefore, it is crucial to start the treatment as early as possible, in order to prevent the definitive fixation of pathological movement scheme.

Treatment of these children is reduced to physical medicine and rehabilitation, orthopedic treatment and application of orthotic devices in order to prevent or treat the existing structural defects that occur secondarily because of the presence of neurological lesions (7). A child that will later in life develop cerebral palsy does not have any deformities or contractures at birth. As child grows and develops, spastic musculature cannot follow the growth of the surrounding structures and tissues, which leads to contractures, deformities and damaged functions. The primary cause of the shortening of the muscle is hypertonia which is always present and long-lasting. In contrast, passive stretching of a relaxed muscle can restore the normal longitudinal growth.

Results of this research show that habilitation methods can influence the muscle tone in early life, that is, during the period when the phenomenon of plasticity of brain function is most prominent. As plasticity decreases with age, it is a lot more difficult to affect the already formed patterns of posture and movement (after the 9th month of life) using any kind of therapeutic procedure. This correlates with the works of other authors (8-11).

Therefore, it is important to start early with the treatment, and that imposes the need for an early diagnosis. This can be achieved only through systematic, continuous monitoring of the development of all the children that are at risk according to their medical histories. That means that the first examination is done in the maternity ward, and every 30 days after that (monthly controls). Thus, the symptomatic risk (muscle tone changes and similar) is timely detected and early habilitation can be applied.

Conclusion

1. Timely (early) habilitation treatment, performed not later than 6 months, has positive therapeutic effects in the regulation of increased muscle tone.

2. In order to start an early treatment, an early diagnosis of the symptomatic risk for problems in motor development is necessary. This is achieved by continuous monitoring of the development of all babies that are at risk.

References

1. Wiles CM. Motor Disorders. Brain. 2000 July;123(7): 1528-30. [T\[CrossRef\]](#)
2. Savić K, Mikov A. Re-Habilitacija dece i omladine. Novi Sad: Ortomedics, 2007. (Article in Serbian)
3. Menkes JH, Sarnat HB, Maria BL, editors. Child neurology. 7th ed. New York: Lippincot Williams & Wilkins; 2005.
4. Campbell SK, Vander Linden DW, Palisano RJ, editors. Physical therapy for children. 3rd ed. Philadelphia: Elsevier; 2006.
5. Pountney T. Physiotherapy for children. Edinburgh: Butterworth Heinemann Elsevier: Oxford; 2007.
6. Bobath K. A Neurophysiological Basis for the Treatment of Cerebral Palsy. 2nd ed. New York: Cambridge University Press; 1991.
7. Levitt S. Treatment of cerebral palsy and motor delay. 4rd ed. Malden, MA: Blackwell; 2004.
8. Chu S, Reynolds F. Occupational Therapy for Children with Attention Deficit Hyperactivity Disorder (ADHD), Part 1: a Delineation Model of Practice. British Journal of Occupational Therapy. 2007 Sep;70(9):372-83.
9. Vojta V. Die zerebralen Bewegungsstörungen im Säuglingsalter. Frühdiagnose und Frühtherapie. Thieme, Stuttgart; 2004. (Article in German)
10. Weindling AM, Cunningham CC, Glenn SM, Edwards RT, Reeves DJ. Additional therapy for young children with spastic cerebral palsy: a randomised controlled trial. Health Technol Assess. 2007 May; 11(16):iii-iv, ix-x, 1-71.
11. Dolenc Veličković T, Veličković Perat M. Basic principles of the neurodevelopmental treatment. Medicina. 2005 ; 42(41):112-120.

HABILITACIONI TRETMAN HIPERTONIJE NOVOROĐENČETA I ODOJČETA

Ljiljana Lazić, Marija Spalević, Dragan Zlatanović, Anita Stanković i Olga Marinković

Kvalitet mišićnog tonusa novorođenčeta i odojčeta važan je parametar za procenu neurološkog sazrevanja, odnosno za otkrivanje neuroloških abnormalnosti. Izmene mišićnog tonusa često se sreću kod tzv. "rizične dece" i mogu biti znak primarnog poremećaja centralnog nervnog sistema (CNS) u smislu ranog oštećenja mozga. Izmena tonusa u smislu hipo- ili hipertonijske u prvim mesecima života smatra se simptomatskim rizikom za smetnje u motoričkom razvoju i zahteva uključivanje u rehabilitacioni tretman, mada je normalizacija često moguća i spontano, bez terapije.

Cilj rada bio je ispitati efekte rehabilitacionog tretmana na smanjenje hipertonusa kod novorođenčadi i odojčadi.

Ispitivanjem je obuhvaćeno 42 dece oba pola, uzrasta od 0 do 12 meseci koja su habilitovana zbog ispoljenog simptomatskog rizika za smetnje u motoričkom razvoju i kod koje je mišićni tonus bio povišen. Tonus je meren pomoću "francuskih uglova" (znak kravate, manevar peta-uvo, poplitealni ugao, abdukcija nogu i dorzifleksija stopala), i to na početku i na kraju tretmana.

Rezultati su pokazali da je kod 32 dece došlo do potpune normalizacije povišenog tonusa do kraja 6. meseca života, kod 7 dece tonus je bio normalizovan do kraja 10. meseca, dok je kod troje dece i dalje perzistirala hipertonijska, ali manjeg stepena u odnosu na početno stanje.

U zaključku se ističe da se najbolji efekti rehabilitacionog tretmana u cilju smanjenja povišenog tonusa mogu očekivati u prva tri meseca života deteta, dakle primenom vrlo rane habilitacije. Ukoliko se zakasni sa početkom tretmana, šanse za normalizaciju su mnogo manje i potrebno je uložiti mnogo više napora kako bi se povišeni mišićni tonus normalizovao. *Acta Medica Medianae 2011;50(1):22-25.*

Ključne reči: hipertonijska, novorođenče, odojče, tretman