National Journal of Clinical Orthopaedics

ISSN (P): 2521-3466
ISSN (E): 2521-3474

www.orthoresearchjournal.com
2021; 5(3): 21-23
Received: 02-05-2021
Accepted: 12-06-2021

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The effect of kinesio taping and physiotherapy on the rehabilitation of children of different ages with obstetric palsy

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DOI: https://doi.org/10.33545/orthor.2021.v5.i3a.286

Abstract
Obstetric palsy (OP) is caused by excessive pulling of the brachial plexus during childbirth. Upper root injury (Erb's), paralysis of the middle area of the plexus and complete plexus injury (Klumpke's paralysis) may be a result of the condition. The application of physiotherapy from the early stages of palsy helps in the rehabilitation of the patient. The aim of this review is to describe research data on the applications of Kinesiotaping (KT) and other means of physical therapy in children with OP, depending on their age. The Google Scholar, PubMed and PEDro databases were searched with the following keywords: obstetric palsy, physiotherapy, Erb's palsy, rehabilitation. The review included nine articles. The results of this review show that the application of physiotherapy means contributes to the recovery of OP. In the first stage of rehabilitation, in infants diagnosed in the first months after birth, physiotherapy may include hydrotherapy, subcutaneous tissue massage, manual massage, limb muscle stretching and KT applied for 2-3 days, then removed for 1-2 days and applied again. In children diagnosed after the first year, Vojta and Bobath techniques, electrotherapy with the application of Transcutaneous Electrical Nerve Stimulation and application of exercises and activities that have the form of play are also suitable. In older children, treatment may include the Vojta technique and the MIRA software platform, where clinical exercises are converted into video games. What seems to determine the results is the early intervention and the cooperation of the rehabilitation team with the parents.

Keywords: Obstetric palsy, physiotherapy, rehabilitation

Introduction
The brachial plexus is formed by the anterior branches of the spinal nerves (C5-C8) and T1. From C5-C6 (or even C4) the upper primary trunk is formed. From C7 the middle primary trunk is formed and from C8-T1 the lower primary trunk is formed [1]. Obstetric palsy (OP) is caused by excessive pulling of the brachial plexus during childbirth. Three types are observed: Upper root injury (Erb's palsy), which is common in overweight babies with shoulder dystocia, the middle area paralysis from C7 fibers to the sciatic nerve and total plexus palsy (Klumpke's paralysis) from traction on an abducted arm. The diagnosis is usually obvious at birth. After a laborious birth, the newborn has a loose or paralyzed upper limb. Clinical evaluation one or two days after birth will determine the type of injury [2].
OP is more common in boys, perhaps due to the greater weight they have compared to girls. It also occurs mainly in the right upper limb, because during childbirth, the right shoulder passes under the pubic symphysis and the right arm plexus is more likely to be injured [3]. It occurs at 1-3 per 1000 births internationally. Specifically, in terms of limbs, the frequency is determined as follows: 58.2% on the upper right, 36.9% on the upper left and 4.9% on both sides. Regarding the type of OP, the percentages are as follows: 80% upper type, 7.5% lower type and 12.5% total type [3, 4]. The prognosis is based on the location and type of injury. In general, the more peripheral the injury, the better the prognosis. Fragoraptis reports that 60% of infants improve in the first two months and 75% by four months. However, after the fourth month the chance of recovery is greatly reduced [5].
The physiotherapist acts according to the age and personality of the child. Thus, the two of them create a relationship of trust and cooperation, which leads to successful nervous

rehabilitation [3]. The main goals of a physiotherapy program for the treatment of OP are to maintain the elasticity of the soft tissues, to learn the motor control using the already existing functional activities, to avoid acquiring pathological patterns and to inform and educate the parents. This is the main mission of physiotherapy as it teaches parents how to apply the exercises in the environment of the child [5]. Physiotherapy tools used in children with OP play an important role in the rehabilitation of paralysis [1, 6].

The aim of this review is to describe research data on the effect of physiotherapy devices that can be used in children with OP, depending on their age.

Literature review

The Google Scholar, PubMed and PEDro databases were searched with the following keywords: obstetric palsy, physiotherapy, Erb's palsy, rehabilitation. Below are the main conclusions of the articles included in this review.

Mannan and Carlstedt, [7] suggests the application of hydrotherapy using the properties of water (buoyancy, resistance, temperature) in all stages of rehabilitation (acute, subacute and chronic). According to the author, both the application of hydromassages through their mechanical effect on the area of the injury and the hydrokinesiotherapy, during which exercises are performed in the water, have positive effects on both infants and older children with OP. More specifically, the author suggests performing range exercises in the water using the property of water buoyancy, while, in an advanced stage of recovery, water resistance can be used as a means of strengthening the paretic muscles of the hand.

Regarding another therapy means, Fragoraptis [5] refers to the application of manual massage and subcutaneous connective tissue massage. Through the classic massage, superficial and deep stroking, gentle petrissage and gentle circular friction are performed for the deeper muscles all over the affected limb towards the center. In this way, elasticity and muscle tone are maintained, edema is better absorbed and the fibrosis observed in inactive muscles is reduced. Before the classic manual massage, the massage of subcutaneous tissue in reflective zones of this limb is applied without oil or cream, thus achieving its best perfusion.

Furthermore, Palomo & Sánchez [8] described physiotherapy tools currently used to improve the function of the affected upper limb in children aged 0-10 years with OP. Their systematic review included 10 studies examining the effect of physiotherapy on OP. The researchers found that the application of constraint-induced movement therapy, Kinesiotaping (KT), electrotherapy, virtual reality and the use of splints or orthotics seem to be able to improve the functioning of the affected limb. In general, a physiotherapy program according to the authors has better results when combined with the use of KT in the initial stage of recovery of the affected limb.

The study of Vata *et al*. [9] involved three age groups with OP. The first involved 15 infants diagnosed with OP within the first three months after birth. These were placed in a supine position with bending of the arm and elbow at an angle of 90° for faster nerve regeneration and easier movement of the limbs, due to the neutralized gravity. The second group included eight infants diagnosed within the first year. Priority was given to the affected limb to lift objects, and joint mobilization, stretching exercises and strengthening the muscles of the whole limb was performed through various types of play. In the third group, seven infants were diagnosed with Erb's palsy after the first year. In these cases, the Vojta and Bobath techniques were used, electrotherapy with application of Transcutaneous Electrical Nerve Stimulation (TENS) and hydrotherapy. The authors emphasized in their results that the time of starting the treatment and the cooperation of the treatment team with the parents are very important for its outcome.

In a case study, Czakó *et al*. [10] presented the rehabilitation of a seven-year-old boy with OP in the left upper limb. In the acute stage, the combination of Vojta treatment and the MIRA software platform was applied. In the next stage of treatment, MIRA was used only for the affected limb. Through this application, clinical exercises in the form of a video game were implemented while the correctness of the exercise and the adherence to the treatment were monitored. Exercises were also given at home (exercises for strengthening the biceps muscle and exercise, where with one arm he held and fixed the ball on the wall). While at first the child did not move the limb at all, after four months of treatment there was an improvement in the biceps with flexion of the elbow against gravity.

O'Berry *et al*. [11] also studied the physiotherapy approach to OP. In the first two weeks, the parents were suggested to place the affected limb of the baby next to its face, touching and playing with its fingers to sensitize them. The authors also stressed that parents should be careful when lifting the baby, so as not to leave behind the limb. During physiotherapy, they suggested stretching, extension of the glenohumeral joint, elbow, wrist and fingers, as well as forearm supination. Finally, the authors recommend KT application for the correct shoulder position.

KT was also the focus of Walsh *et al*. [12], described the treatment of a two-year-old girl with OP using KT. Initially, the tape was placed on the anterior and posterior part of the deltoid muscle of the affected limb, for 2-3 days, then removed for 1-2 days and re-applied. After two weeks, the application was modified to include shoulder stabilizer muscles. The treatment lasted a total of 20 weeks. KT was combined with play activities to facilitate muscle function and bone changes. The child managed to support her body weight with both upper limbs, resulting in the cancellation of the surgery. The application of KT continued for the next four months with a reduced number of days per week and then stopped with the improvements being maintained.

Additionally, on the subject of KT, Hassan *et al*. [13] studied its efficacy in upper limb motor functions in children with brachial plexus paralysis, based on the 5 clinical studies included in their systematic review. The researchers concluded that the application of KT in the physiotherapy program may have an effect on functional improvement, but this may be limited depending on the technique of application. For this reason, it is a questionable issue and they recommended further higher quality studies to provide better evidence of the use of KT.

Lastly, Kamal-Eldeen *et al*. [14] studied the effect of KT on wrist muscle contraction in children with Erb's palsy. The study was conducted in a hospital, where 30 children with Erb's palsy (aged one month - three years) were divided into two groups of 15 patients. One group was control with the children receiving a physiotherapy program, which included neuromuscular stimulation, graduated active exercises and gentle stretching of the limb muscles. In the second group, in addition to the physiotherapy program, KT was applied to these children. The results showed significant improvement in both groups, but there was a greater improvement of the wrist muscles in the intervention group.

Discussion - Conclusions

The results of this review show that in the case of obstetric

paralysis, the physiotherapy program in the first stage of rehabilitation in infants diagnosed in the first months after birth, may include hydrotherapy, subcutaneous tissue massage for better perfusion, manual massages to maintain of elasticity, muscle tone, and absorption of edema, and stretching of limb muscles [5,7-8]. In most studies where KT is mentioned, its application is indicated and it is recommended in the initial stage of rehabilitation, to be combined with the physiotherapy program for better results [11-12, 14]. Specifically, its application must be done for 2-3 days, then removed for 1-2 days and then re-applied [12]. However, Hassan *et al*. [13] in their systematic review, concluded that further higher quality studies should be conducted for KT. In children diagnosed after the first year, Vojta and Bobath techniques, electrotherapy with application of TENS and application of exercises and activities that have the form of play can be used in addition. In older children, treatment may include the Vojta technique and the MIRA software platform, where the clinical exercises are converted into video games, with which the child engages, thus monitoring the correctness of the exercise and the adherence to the treatment. Moreover, in all cases it is recommended to perform exercises at home, which include exercises for the biceps and for children over one year old, shoulder stabilization exercises. What plays the most important and crucial role in rehabilitation is the early intervention and cooperation of the treatment team with the parents.

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