IMPACT OF KINESIOTAPING IN IMPROVING HEAD CONTROL AMONG CHILDREN WITH SPASTIC DIPLEGIC CEREBRAL PALSY

Jaya Dixit¹, Sujoy Roy¹, Animesh Kumar² and OP Singh³

¹Occupational therapist, Sir Sunderlal hospital, Banaras Hindu University, Varanasi, Uttar Pradesh, India
²Rehabilitation Department, Kiran society, Madhopur, Varanasi, Uttar Pradesh, India
³Medical Science, Banaras Hindu University, Varanasi, Uttar Pradesh, India

ARTICLE INFO

Article History:
Received 9th March, 2018
Received in revised form 17th April, 2018
Accepted 20th May, 2018
Published online 28th June, 2018

Key words:
kinesiotape, neurodevelopmental therapy, muscle belly, proprioception, therapeutic activities.

ABSTRACT

Background: Attaining head control is frequently used as the starting point in therapeutic intervention for the children with cerebral palsy. Application of kinesiotape along with other approaches for treatment of cerebral palsy helps in improving early head control. The purpose of the study is to find out the effect of applying kinesiotape over sternomastoid and trapezius muscles to improve head lifting, head turning and head holding capacity of children with cerebral palsy.

Objective of study: The study was undertaken to investigate the effectiveness of combined approach of neurodevelopmental therapy and kinesiotaping on improving head control of children with Cerebral palsy.

Method: The study was conducted in Occupational therapy unit of Sir Sunderlal Hospital, Banaras Hindu University Varanasi. Written ethical permission was obtained from the Institute of Medical Science Banaras Hindu University Varanasi. The parents of the selected children were explained about the study and a written informed consent was obtained from them. Baseline scores were obtained by using GMFM, CSHC, VAS and GAS. Children with cerebral palsy who were fulfilling inclusion criteria were divided into 2 groups conveniently, 100 experimental group and 100 control group. Children in experimental group were provided activities providing neurodevelopment therapy along with kinesiotaping over the muscles belly of sternomastoid and trapezius. In control group children were provided with activities providing neurodevelopment therapy. Therapy for both the groups was provided for 5 weeks regularly in occupational therapy unit. On every 5th day from the application of kinesiotape is changed as it gets loose and elasticity is compromised due to stretch on kinesiotape while performing therapeutic activities and activities of daily living.

Results: Results of Wilcoxon signed rank test of GMFM are significant for experimental group and control group with $P = 0.004$ & $P = 0.041$ and $Z = -2.36$ & $Z = -2.08$ respectively with level of significance set at $P \leq 0.05$. There is significance of results of Wilcoxon signed rank test of CSHC in experimental and control group. The $P$ and $Z$ value for experimental group is $P = 0.005$ & $Z = -2.36$ and for control group is $P = 0.005$ & $Z = -2.08$ with level of confidence set at $P \leq 0.05$, which shows that results were significant for experimental group as well as control group. Also the results of Mann Whitney U test show that $Z = -3.507$ making it more sensitive to capture changes in balances in children than GMFM with $Z = -3.905$ with $P = 0.002$ & $P = 0.001$ with level of significance set at $P \leq 0.05$.

Conclusion: It can be concluded that application of kinesiotape along with neurodevelopmental therapy can be used to enhance & improve head control among children with Spastic diplegic cerebral palsy, so that they can explore the environment effectively for playing.

INTRODUCTION

Cerebral palsy is a disorder of posture and movement due to a defect or lesion in the immature brain. Cerebral palsy affects 1.5 to 2.5 per 1000 live-births. Cerebral palsy is often associated with sensory deficits, cognition impairments, communication and motor disabilities, behavior issues, seizure disorder, pain, and secondary musculoskeletal problems. Head control is defined as the ability to keep the head aligned with respect to gravity. Head control is the ability to maintain head in space face vertical and mouth horizontal. Lack of head control is often the first sign of abnormality in children with atypical development. Thus, attaining head control is frequently used as the starting point in therapeutic intervention for the children with cerebral palsy or other developmental disabilities by the Pediatric occupational therapist. Head control is the first motor milestone to be achieved. Good head control lays the foundation for the development and refinement of other milestones. It also enables the child to explore the environment effectively in play and to develop more advanced skills. The poor head and trunk control in children with cerebral palsy...
produce limitations in feeding, drooling and bathing, affecting all aspects of activities of the daily living.

Kinesio tape is the name of an adhesive tape created by Kenzo Kase in Japan in 1973. Over the past years, the concept of Kinesio tape has spread extensively and was designed to mimic the elasticity of human skin (in terms of weight and thickness). The tape is completely made of cotton with an anti-allergic adhesive layer that allows for evaporation and quick drying. These properties make it resistant and wearable for a long period, in general, 3 to 5 days at a time; it is even water resistant. The tape has an elasticity of up to 140%, equal to that of human skin. The tape may be applied in different ways, such as the following: I shape (the strips are placed in the area above the muscle belly), Y shape (surrounding the muscle belly), X shape (from a central point surrounding the muscle belly), octopus shape (for lymph drainage), donut shape (to increase space) or star shape (to increase central space). The creator of this technique described its therapeutic effects, which will depend on the extent to which the tape is stretched and the shape of application. It has also been used successfully in the field of orthopedics, traumatology, and sports. In the past years, new applications have emerged in the field of neurology, rheumatology, and even urology. Comparative studies have been made between the effects of KT and other taping modalities already in place for many years. However, and in spite of its popularity, few scientific studies have been conducted to support KT use in cerebral palsy. What is being advocated about KT is that, together with other therapeutic interventions, it may promote a comprehensive rehabilitation process, increasing autonomy to perform basic activities of daily living and improving their quality.

The literature on intervention provided for the trunk and head control of children with cerebral palsy is scarce. The occupational therapy interventions for the promotion of postural control and balance consist of postural orientation exercises, and exercises to strengthen the neck, back, and the musculature of the upper limb. There is paucity of study showing the effect of kinesiotape application on neck for the development of head control in children with cerebral palsy. The purpose of the study is to find out the effect of applying kinesiotape over sternomastoid and trapezius muscles to improve head lifting, head turning and head holding capacity of children with cerebral palsy.

**METHODOLOGY**

**Place of study**

The study was conducted in Occupational therapy unit of Sir Sunderlal Hospital, Banaras Hindu University Varanasi.

**Sample size and sampling method**

200 children with spastic diplegic cerebral palsy were recruited for the study. From Department Of Pediatric and Department Of Neurology children were diagnosed as Spastic diplegic cerebral palsy and were referred to Occupational therapy unit of Sir Sunderlal Hospital. It was pre test & post test experimental study. Convenient sampling was done with assigning the child to alternate groups as they arrived for treatment at Occupational therapy unit.

**Inclusion criteria**

- Children diagnosed as Spastic diplegic cerebral palsy.
- Males and females aged 6 months to 6 years.
- Children who were medically stable with no chronic illness or any co morbid condition.

**Exclusion criteria**

- Spastic diplegic cerebral palsy children with visual impairments were excluded from the study.
- Spastic diplegic cerebral palsy children associated with hydrocephalus were not included for the study.
- Spastic diplegic cerebral palsy children having aggressive or self-injurious behavior were excluded.
- Those children who went through cervical surgeries were excluded.
- Spastic diplegic cerebral palsy children having involuntary movements of the head were excluded.

**Instruments used**

Clinical scale for head control (CSHC): A scale to measure changes in ability to control head in children with spastic diplegic cerebral palsy. It is a clinical rating scale for head control published by Shashidhar Rao Chavan, in his study “Clinical rating scale for head control - a pilot study ” in The Indian Journal of Occupational Therapy : Vol. XXXIX : No. 3 (December 2007 - March 2008)

Functional assessment. The outcome measures to measure the head posture improvement will be Gross Motor Function Measure-88 (GMFM-88). Baseline score of GMFM was obtained to know the present status of head control of children who were recruited for the study and then scores were taken at each sitting after 5 days for 5 sittings.

Visual Analogue Scale (VAS). VAS is a valid scale that consists of a line of 100 mm separating two labels: 0= “No head control” and 10= “Perfect head control”. We asked parents to put a cross on the line of 100mm separating these two labels to indicate on the VAS the level of head control of the children.

Goal attainment scale (GAS). GAS allows the therapist to program a desired improvement and to judge if the child achieved it (the fact that the goal is chosen by therapist made this scale very sensitive). The goal is related to movement of the head of children with cerebral palsy. Our goal was to measure the amount of head lifting, turning and head control achieved by the child.

**Procedures**

A written ethical permission was obtained from the Institute Of Medical Science Banaras Hindu University Varanasi. The parents of the selected children were explained about the study and a written informed consent was obtained from them. This study started with neurological evaluation of children with cerebral palsy in an assessment format. Then all the baseline scores were obtained using GMFM, CSHC, VAS and GAS.

Children with spastic diplegic cerebral palsy were divided into 2 groups conveniently, 100 experimental group and 100 control group. Children in experimental group were provided activities providing neurodevelopment therapy along with kinesiotaping over the muscles belly of sternocleidomastoid and trapezius. Control group was provided with activities providing neurodevelopment therapy. Therapy for both the groups was provided for 5 weeks regularly in occupational therapy unit. On every 5th day from the application of kinesiotape is changed as it gets loose and elasticity is compromised due to stretch on
RESULTS

There were 100 children in experimental and control groups pre therapy. There was 5 drop out in experimental group and 7 drop out in control group. In GMFM minimum score and maximum score in experimental group pre and post therapy are 7 & 12 respectively with mean of 9.5 and standard deviation of 8.52. In control group minimum scores are 7 & 11 pre & post therapy. Maximum scores are 11 & 17 in pre and post therapy with mean of 9 & 14, having standard deviation of 9.66 and 4.76.

Protocol

Children were properly positioned on couch in supine with head turn on one side so as to exposed the tendon of sternocleidomastoid muscles and supported sitting of children with neck flex was the position for proper visibility of trapezius muscles. Parents were asked to hold this position of children for 10 second and kinesio tape is applied from one end of the muscle to the other with very little to no stretch on the tape and extreme stretching of tape was avoided. Rubbing of surface of kinesiotape was done to activate adhesive of kinesiotape. It was applied over the belly from insertion to origin in I shape to trapezius and in Y shape to sternocleidomastoid in experimental group. Before the application of kinesiotape following points were noted no hair, no oil/lotions and the skin should be dry in the area were kinesiotape is being applied.

Activities were provided for the head control and strengthening of the neck, back, and the musculature of the upper limbs to the children with cerebral palsy in experimental and control group.

1. Prone on chest with pillow below the chest and toys were provided to raise the head and look at the toys.
2. Child was made to sit with support of parents holding both the scapula with both hands and adduct both the scapula by pushing scapula from below and pulling scapula back on the upper border stimulating neck muscles and making the child look at the toys in front of the head.
3. Pull to sit from supine to sitting with lower extremities extended.
4. Activities were provided no gymball for head lifting, child was placed prone over the gymball and gymball was rotate toward the leg of the child and child asked to lift the head. Supine to sit was also performed over the gymball with gravity assistance for sitting for the child.

Figure 1: Showing a Child, having kinesiotape over the neck

Figure 2: Showing a Child, Performing activities over the gymball

Table 3 Results of Wilcoxon Signed Rank Test (Clinical Scale for head control)

<table>
<thead>
<tr>
<th>Groups</th>
<th>Z (2 tailed)</th>
<th>P (2 tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>-2.36</td>
<td>0.005</td>
</tr>
<tr>
<td>Control</td>
<td>-2.08</td>
<td>0.005</td>
</tr>
</tbody>
</table>

Table 3 Results of mann whitney U Test

<table>
<thead>
<tr>
<th>Groups</th>
<th>Z (2 tailed)</th>
<th>P (2 tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>-1.06</td>
<td>0.005</td>
</tr>
<tr>
<td>Control</td>
<td>-1.00</td>
<td>0.025</td>
</tr>
</tbody>
</table>

* For both the groups P value is significant

GMFM is Gross Motor Functional Measure *CSHC is Clinical Scale for Head Control

Mean difference was 6 for experimental group for pre & post therapy. For control group mean difference was 5 pre and post therapy. In CSHC minimum score and maximum score in experimental group pre and post therapy are 6 & 16 respectively with mean of 11 and standard deviation of 5.25. In control group minimum scores are 8 & 10 pre & post therapy.

Descriptive characteristics of pre scores/post scores changes along with mean and mean difference of total score range of GMFM in both experimental and control group subjects.

<table>
<thead>
<tr>
<th>Group</th>
<th>No of subjects</th>
<th>Minimum scores</th>
<th>Maximum scores</th>
<th>mean</th>
<th>Std.deviation</th>
<th>Mean difference (pre-post)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>Pre</td>
<td>100</td>
<td>6</td>
<td>16</td>
<td>11</td>
<td>5.25</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>95</td>
<td>12</td>
<td>21</td>
<td>16.5</td>
<td>7.18</td>
</tr>
<tr>
<td>Control</td>
<td>Pre</td>
<td>100</td>
<td>8</td>
<td>11</td>
<td>9.5</td>
<td>8.61</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>93</td>
<td>10</td>
<td>14</td>
<td>12</td>
<td>3.26</td>
</tr>
</tbody>
</table>

* For both the groups P value is significant

Descriptive characteristics of pre scores/post scores changes along with mean and mean difference of total score range of CSHC in both experimental and control group subjects.

<table>
<thead>
<tr>
<th>Group</th>
<th>No of subjects</th>
<th>Minimum scores</th>
<th>Maximum scores</th>
<th>mean</th>
<th>Std.deviation</th>
<th>Mean difference (pre-post)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>Pre</td>
<td>100</td>
<td>6</td>
<td>16</td>
<td>11</td>
<td>5.25</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>95</td>
<td>12</td>
<td>21</td>
<td>16.5</td>
<td>7.18</td>
</tr>
<tr>
<td>Control</td>
<td>Pre</td>
<td>100</td>
<td>8</td>
<td>11</td>
<td>9.5</td>
<td>8.61</td>
</tr>
<tr>
<td></td>
<td>Post</td>
<td>93</td>
<td>10</td>
<td>14</td>
<td>12</td>
<td>3.26</td>
</tr>
</tbody>
</table>

* For both the groups P value is significant

*GMFM is Gross Motor Functional Measure *CSHC is Clinical Scale for Head Control
Maximum scores are 11& 14 in pre and post therapy with mean of 9.5 & 12, having deviation of 8.61 and 3.26. Mean difference was 5.5 for experimental group for pre & post therapy. For control group mean difference was 2.5 pre and post therapy. Results of Wilcoxon signed rank test of GMFM are significant for experimental group and control group with $P = 0.004$ & $P = 0.041$ and $Z = -2.36$ & $Z = -2.08$ respectively with level of confidence set at $P \leq 0.05$. There is significance of results of Wilcoxon signed rank test of CSHC in experimental and control group. The $P$ and $Z$ value for experimental group is $P = 0.005$ & $Z = -2.36$ and for control group is $P = 0.005$ & $Z = -2.08$ with confidential interval value set at 0.05, which shows that results were significant for experimental group as well as control group. Also the results of Mann Whitney U test show that $Z = -3.507$ making it more sensitive to capture changes in head control in children with spastic diplegic cerebral palsy. GMFM with $Z = -3.905$ with $P = 0.002$ & $P = 0.001$ with level of confidence set at $P \leq 0.05$.

**DISCUSSION**

In this study, it was found that the head lifting, head turning and head holding abilities of children with cerebral palsy were significantly improved [p < 0.05] with application of kinesiotape as compared to the control group. Based on these studies, kinesiotaping is effective in mild to moderate children with spastic diplegic cerebral palsy and is not effective in severe spastic diplegic cerebral palsy children. In this study improvement in head control of spastic diplegic cerebral palsy children may be attributed to improvement in the strength of sternocleidomastoid and trapezius muscles, enhancement of endurance of these muscles and reduction of spasticity. 

**Possible Mechanism of Kinesiotaping in treating ability to head control in children with cerebral palsy**

Kinesiotaping is a relatively new technique used in rehabilitation program to treat children with cerebral palsy. The use of kinesiotaping in conjunction with child’s regular therapy program may favorably influence the cutaneous receptors of the sensorimotor system resulting in subsequent improvement of voluntary control and coordination of the muscles. Kinesiotaping when applied properly can theoretically improve the following: strengthen weakened muscles, control joints instability, assist with postural alignment and relax overused muscles. Kinesiotape helps in normalization of muscle function by either facilitation or inhibition mechanisms. If kinesiotape is applied from the muscle origin to the insertion with strong tension i.e. 50-70% of its original length, this may enhance muscle contraction. Applying kinesiotape helps in facilitating a weakened muscle or to relax an overused muscle. Kinesiotape can be a valuable addition to the treatment protocol as it has been shown to have positive physiological effects on the skin, lymphatic vessel and subsequent circulatory system, as well as having a physiological effect on the fascia, muscles, ligaments, tendons and joints. Psychological effect of Kinesiotape can encourage children’s parents to provide therapy at appropriate interval and on regular basis and also it motivated them to provide therapeutic activities to their children with cerebral palsy. The original site was selected at the origin of sternocleidomastoid and trapezius for the desired pulling force and the insertion of two muscles was determined by the desired strength of the pulling force. The direction of the force is usually parallel to the direction of muscle fibers. Kinesiotape can control the pulling force to the tendon of sternocleidomastoid and trapezius in order to facilitate these muscles. In most cases, the cause of poor head control is due to the abnormal tone or strength of neck muscles. By applying kinesiotaping on the sternocleidomastoid and trapezius muscles, the pulling force of these two muscles can be improved. The tapes stimulated the skin area it covers [tactile stimulation]. The direct mechanical stimulation [from the shearing force of taping] to proprioceptors and mechanoreceptors plays role in facilitation of muscles. This mechanism could be similar to hyper stimulation in the case of acupuncture or trigger point injection.

The possible improvement in the local circulation may also facilitate the resolution of the tone. Unfortunately; we did not assess the change in circulations to these muscles. Kinesiotape when applied to the sternocleidomastoid and trapezius muscles of the neck and face helps to recover motor control, by strengthening muscles and helping with proprioception and Re-educates neuromuscular system. Studies reported that the kinesiotape acts as a continuous stimulus through cutaneous innervations in the neck region, therefore providing feedback and perceptive information.

**Changes in Subjective ability to head control after applying kinesiotape**

Pratt & Coley (1989), Halpern (1990) & Colangelo (1983) described assessment of head control by the pediatric occupational therapist that includes examining the quality of posture and movement in three positions: prone, supine, and supported sitting 5,6,7. Bobath (1980) describe the degree to which a child has acquired head control as: poor, fair, stable. The increase in scores of Visual Analogue Scale and Clinical Scale for Head Control were significantly more in the experimental group than in the control group. It appears that kinesiotaping can effectively improve head control. However, the difference was not significant for sever type of cerebral palsy. This is probably due to the limitation of time in our study. Further study is required to clarify this.

**Limitation**

1. Sample size was small, making it difficult to generalize the findings.
2. The effectiveness of Kinesiotapping was seen for the short period of time as the time assigned to the study was over a 13-months period only.
3. One of the limitations of this study was the small number of relevant published studies.

**Recommended**

1. It is necessary to develop future studies with larger samples and longer periods of time because improvement in these patients is sometimes slow, and it takes time to assess whether Kinesio Tapping is effective or not.
2. Effects of kinesiotape with other treatment approaches can be seen in the children with Cerebral Palsy.
3. The efficacy of Kinesiotape can be seen in other neurological diseases, such as stroke and head injury.
4. Improvement in the local circulation due to kinesiotape can be recorded.

**CONCLUSION**

It is concluded that application of kinesiotape continuously for one month can improve children abilities to lift, turn and hold head vertically with a better effect as compared to those treated with only a traditional occupational therapy program. Proper
head control enables the child to explore the environment effectively in play and provide platform to develop more advanced skills

Declarations of interest: The author reports no conflict of interest. The author alone is responsible for the content and writing of this paper.

References


How to cite this article:

**********