

Effect of Kinesiotape as an Adjunct to Oral Motor Therapy on Drooling in Children with Neurological Impairment

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Abstract

Objective: To investigate whether application of kinesio taping as an adjunct to oral motor therapy is beneficial and time efficient in reducing drooling and enhancing mouth closure inspite of oral motor therapy alone and to investigate the social stigma associated with drooling.

Background: As the child grows, the rate of drooling decreases due to the maturation of Oral Motor-Sensory functions and will lead saliva control. However, if the drooling continues after 4 years of age in the awake state is considered abnormal. Oral Motor Therapy includes active and passive exercises, and sensory stimulation. Kinesio tape in pediatrics is an emerging field with various studies conducted on its use in children with cerebral palsy in improving motor function and motor impairment.

Materials and methods: Experimental trial in which 30 neurologically impaired children with drooling were randomly allocated to Oral Motor therapy alone (Group A) and in kinesio tape and oral motor therapy intervention (Group B). Primary outcome measures were Drooling Impact Scale, Thomas-Stonell Drooling scale and Lip closure measurement. RESULT: Both the groups were found to be significantly effective in reducing drooling but the combination of kinesio taping with oral motor facilitation in group A was found to be more effective in enhancing mouth closure and reducing frequency and severity of drooling.

Conclusion: Oral Motor stimulation was proved to be significantly beneficial in reducing the frequency and severity of drooling in neurologically impaired children. Time efficient treatment for the controlling drooling was statistically significant in intervention using kinesiotaping and oral motor therapy. Also, the quality of life of the children was also improved with the above intervention protocol.

Keywords: Drooling; Kinesio tape; Oral motor therapy; Neurological impairment

Introduction

The process of perception-action coupling contributes to the maturation in saliva control [1]. In the early development of saliva control, few correlations are considered crucial such as sensory stimulation by experiencing the feeling of saliva in the mouth or over the lips and chin, forming a salivary bolus before swallowing, and, behavioral modifications such as sensory based motor actions like learning to engulf saliva when felt over the lips and out of oral cavity. All these modifications are considered essential to achieve the perceptual experience for adequate motor action to change the drooling behavior in children. Impairment in the control of saliva is also due to the outcome of poor oral muscle tone or dysphagia. There has been evident correlation shown between the impaired oral sensation and salivary flow [2]. In summary, the most frequent cause in the drooling of saliva in neurodisability is categorized under the set of 3 headings:

- Difficulties in oral motor function when swallowing,
- Sensory disturbances around the mouth leading to impaired swallowing of saliva,

- Lack of correlation between the sense of spilling of saliva and swallowing process [3,4]

Oral Motor Therapy involves innervating sensory nerves for exact working of the mouth contents (lips, jaw, tongue, soft palate, larynx) and respiratory muscles which are meant to effect the physiological support of the oral-pharyngeal process and thus improving it's functions. Oral-motor exercises may also include active exercises, stretching, passive exercises, and sensory nerve stimulation" [5,6].

The mechanism of kinesio tape remains however unclear, but the hypothesis supports the bracing of cutaneous receptors which further improves the proprioception and neuromuscular functions. The use of kinesio tape in pediatrics is an emerging field with various studies conducted on its use in children with cerebral palsy (CP). In CP child, kinesio tape is utilized in managing postural control and sitting, promoting power or grip strength and active range of motion of wrist and thumb, in treating chronic constipation in CP child, in improving motor function and motor impairment [7-10]. Techniques used in management of oral motor control in children with neuromuscular impairment and impaired Temporomandibular (TM) joint function are:

- stabilization of TM joint,
- stabilization of jaw in order to reduce drooling,
- facilitation of orbicularis oris for better lip closure.

With this view, we hypothesize the use of kinesio tape as an adjunct to oral motor therapy for the better closure of the mouth and to enhance the sensory processing in order to decrease the impact of drooling and to reduce the social non-acceptance of children with neurodisability with drooling. The application of kinesio tape has been proved to be effective in reducing mouth closure and hence drooling [11]. However no studies have evaluated the comparative effect of kinesio tape and oral motor therapy together for management of drooling in time effective way. The aim to the study is to compare the effects of Kinesio Taping along with Oral Motor Stimulation with Oral Motor Stimulation alone in children with drooling.

Methods

The study was performed at Dr. D.Y. Patil College of physiotherapy and Dr. D.Y. Patil Ayurved and Research Centre, Zep Rehabilitation Centre and Renuka Shishu Gruh situated in Pimpri-Chinchwad, Pune, Maharashtra. Demographic data along with written informed consent was obtained from parents and care takers of 30 children between the age group 1-9 years with drooling due to neurological impairment. Purpose of the study was explained to all the parents of the participants with informed consent taken. To select the study participants' parents or care takers were asked to point out the children who showed continuous drooling. The children were selected for collection of data from interviews with care takers, diagnosed neurological impairment, current medications, ongoing therapies and swallowing complaints. The study was approved by Institutional Research Ethical Committee. The inclusion and exclusion criteria applied to children are mentioned below:

Inclusion criteria

- Age- 1-9 years old
- Both the girl and boy child
- Presence of any neurological impairment
- Complaint of drooling

Exclusion criteria

- Child on drugs or medication that controls saliva production or could affect the drooling
- Participation in other form of therapy such as speech language therapy before or during the study
- With the history of recurrent aspiration pneumonia
- Allergic reaction to the use of kinesio tape
- Child not able to co-operate or tolerate the kinesio tape

Experimental procedure

The procedure lasted for 30 days and consisted of two interventions (oral motor therapy plus kinesio tape and oral motor therapy alone) in two groups thrice a week for 30 minutes per session. Children were randomly divided into two groups of 15 children who met the inclusion criteria for study. Data for drooling was collected using Thomas-Stonell and Greenberg drooling scale, Lip Closure measurement and The Drooling Impact Scale on 1st day of treatment then after the end of every week for 4 weeks i.e. pre-assessment, after 1 week, 2 weeks, 3 weeks and post-intervention assessment.

Oral motor stimulation was carried out in 4 different modes: manipulation, vibration, deep pressure and icing.

Manipulation techniques such as intra-oral massage, tapping and stroking was applied using fingertips. This was given for 10 mins. Oral Vibration was applied using the thumbs and fingers over the orbicularis oris muscle, over the gums and intra-orally in the mouth. Deep pressure with the finger will be applied to the orbicularis muscle by the therapist. This technique will activate the proprioceptors and will be given for 5 mins. Icing is a procedure which aims to normalize muscle tone, thereby improving oral-motor function and enhancing sensory awareness. It involves the application of ice directly over the orbicularis muscle for 5 mins.

After Oral Motor therapy, the intervention was continued with the application of Kinesio Tape. Each child was comfortably seated in a chair with correct posture in order to avoid head hyperextension. The skin overlying the orbicularis muscle (superior and inferior) area was cleaned with the sterilized cotton.

To facilitate lip closure

The distance between the corners of the mouth and philtrum was measured with calipers to define the length each tape. The Kinesio Tape was made to cut according to these measurements and was applied with the maximum stretch (one bandage on the upper lip and the other on the lower lip) as shown in Figure 1.



Figure 1: Application of kinesio tape over upper and lower lip.

Application was performed in the same way for all children. Tape was applied every alternate day (3 times/week). Parents and teachers were advised to avoid unintentional removal of the tape and to refrain from putting the tape back on when it fell off spontaneously, instead waiting for the next application by the physical therapist. Skin was assessed every time the new tape was applied for any rash or other skin changes.

The assessment was carried out at the baseline and after the end of 3 sessions (i.e. 1 week) for 4 weeks. For evaluation of drooling, three parameters were calculated viz. lip closure measurement using Vernier caliper (the interlabial gap was measured), severity and frequency of

drooling using Thomas-Stonell Drooling Scale and the life quality of children with drooling and its impact on the parents/caregivers life.

For kinesio tape and oral motor therapy group, the child was positioned comfortably either in therapist lap or in mother’s lap or on the mat in supine position. The intervention was started with the manipulation techniques for oral motor stimulation using manipulation, vibration, deep pressure and icing. It was followed by application of kinesio tape over the upper and lower orbicularis oris muscle. Effect of kinesio tape was assessed after the end of every week with Vernier caliper. To find the effect of oral motor therapy, the drooling impact and the frequency and severity of drooling scales were used. The questionnaire was completed by the therapist and family.

For oral motor therapy group, the same oral motor therapy intervention was given to the children in group B and followed the same procedure afterwards.

All interventions and evaluation was assessed by the same therapist in all children.

Statistical analysis

- The data was entered in excel and was analyzed in a statistical software.
- The data was presented using descriptive statistics (Mean, Median & Standard Deviation)
- The data was then explored for normality.
- Appropriate test of significance was used for the data.
- Differences in the mean Thomas-Stonell drooling scale, drooling impact scale, lip closure & social stigma within the groups was done using the wilcoxon signed ranked test.
- Differences in the mean Thomas-Stonell drooling scale, drooling impact scale, lip closure & social stigma between the groups was done using the Mann whitney test.
- A value of $p > 0.05$ at 95% confidence interval was considered statistically significant.

Results

Of the total 30 children participated in the study, 2 participants in group A could not make it to the completion of study as 1 children was unable to cooperate with the treatment protocol and for the other one, parents or guardians refused to do follow ups after 1 week of session. The characteristics of 28 children were then studied who received 30 days of treatment.

Comparison of age, gender and neurological impairment is given in the following Tables 1 to 3:

Parameter	Group A (n=15)		Group B (n=15)		Z Value	p Value
	Mean	SD	Mean	SD		
Age (Years)	4.92	2.496	5.91	3.156	0.96	0.35

Table 1: Age comparison in groups A and B.

Neurological impairment	Group A	Group B	Total
ADHD	0	1	1
Autism	2	2	4
Developmental Delay	1	0	1

Diplegic CP	3	1	4
Down Syndrome	0	1	1
Dystonic CP	2	3	5
Intellectual Disability	1	0	1
Mental Retardation	2	1	3
Mixed CP	0	1	1
Seizure Disorder	1	0	1
Spastic Diplegic CP	2	1	3
Spastic Quadriplegic CP	1	4	5
Total	15	15	30

Table 2: Neurological impairment wise distribution of cases in group A and group B.

Gender	Group A	Group B	Total
Male	9	8	17
Female	6	7	13
Total	15	15	30

Table 3: Gender wise distribution of cases in group A and group B.

The statistical analysis was done for the interventions given in both the groups comparing the effect of Thomas-Stonell Drooling Scale in group A and group B as shown in Figure 2.

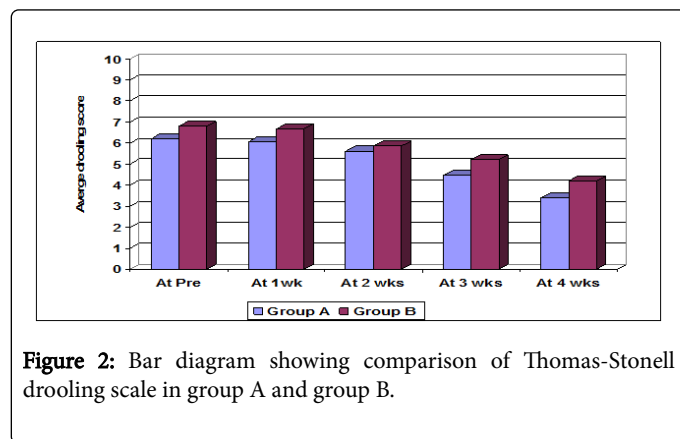


Figure 2: Bar diagram showing comparison of Thomas-Stonell drooling scale in group A and group B.

The values of this analysis came out to be statistically non-significant with p value more than 0.05 ($p > 0.05$). Group B having more score than Group A (mean value at the end of 4 weeks in group B=4.20 and in group A=3.38). Also, the result of the same scale was compared in between the groups separately at the end of every week which showed significant reduction in group A as well as in group B with p value was less than 0.05 (group A mean=3.38 at the end of 4th week, group B mean=4.20 at the end of 4th week).

The statistical analysis for the Drooling Impact Scale was done in the same way for both the group as shown in Figure 3.

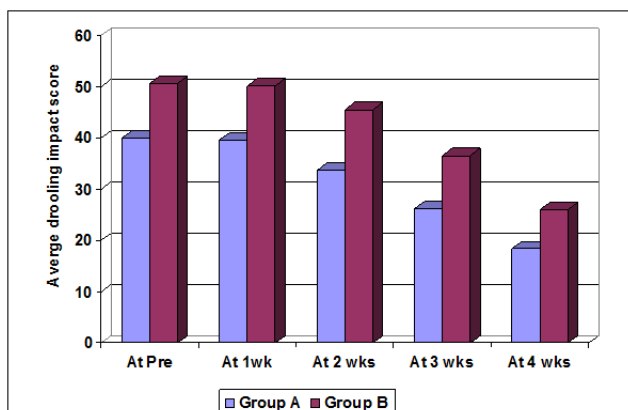


Figure 3: Bar diagram showing comparison of drooling impact scale in group A and group B.

The inter group comparison came out to be statistically significant with p value less than 0.05 ($p < 0.05$) although, the Group B showed more significant reduction in the values than Group A. The week wise comparison in Group A showed that there was no significant reduction of Drooling Impact Scale at 1 week in group A and significant reduction of values in the scale at 2 week, 3 weeks and 4 weeks of treatment as p is less than 0.001 ($p < 0.001$). Group B with the Drooling Impact Scale showed the same results.

For the lip closure measurement as shown in Figure 4 done by Vernier caliper at the end of every 3rd session showed significantly more reduction of values in group B (kinesio tape application plus oral motor stimulation) as compared to Group A in which only oral motor stimulation was given.

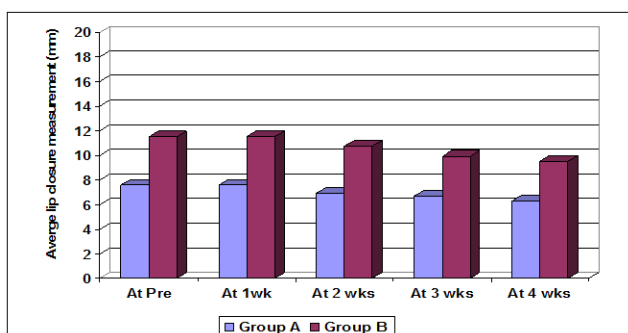


Figure 4: Bar diagram showing comparison of lip closure measurement in group A and group B.

The data shows that there was statistical significant reduction in lip closure at the end of 1st and 2nd week as the p value was less than 0.05. But the data reveals no significant reduction of values at the end of 3rd and 4th week as p value came out to be more than 0.05 ($p < 0.05$). The results of this measure suggested that lip closure was also improved with the oral motor therapy alone but less than that seen in kinesio-tape and oral motor stimulation together.

Again the lip closure measurement was done individually in both the groups. Lip Closure Measurement was same at 1 week in group A

and significantly reduced at 2 week, 3 week and 4 weeks as p value came out to be less than 0.005 ($p < 0.005$). In group B the values of measurement were same at 1 week post treatment and reduced significantly at 2 weeks, 3 weeks and 4 weeks as p value came out to be less than 0.0001 ($p < 0.0001$). The data reveals that in spite of not using kinesio tape in group A, there came out to be significant reduction with the oral motor stimulation alone. Although the values were less in group A as compared to group B in which kinesio tape was applied for the same.

The study has also seen the social stigma faced by the parents or care takers of the children with neurological impairment having complaint of drooling. To see this effect, 3 questions from the Drooling Impact Scale (Q7, Q9 and Q10) were taken and compared the pre and post intervention values. The subjects were categorized as Good, Average and Poor.

In group A the pretest assessment, the percentage of cases in the Good category were 73.33% which went to 100% post treatment. Whereas, the average and poor category in group A had 26.67% and 0% respectively pretreatment, this went to nil in both the cases.

In group B pre-test assessment, only 20% of the cases were in the Good category, whereas, posttest percentage increased to 93.33% of cases. Also the cases in average category were 73.33% pre-test and went down to 6.67% post-test whereas, the poor category had only 6.67% of cases in pre-test assessment which went to nil after 4 weeks of treatment. The factor of social stigma showed more improvement in group B posttest.

Discussion

The current study has analyzed the effect of conventional oral motor therapy along with kinesio taping in two groups. The results revealed that both the groups showed significant improvement on drooling in Drooling Impact Scale, Thomas-Stonell Drooling scale (the drooling frequency and intensity scale), the Lip Closure Measurement and aspect of Social Stigma. But the Group B (Oral Motor Therapy along with kinesio tape for orbicularis oris) showed more improvement than Group A in which only conventional Oral Motor Therapy was given.

The between group analysis that combination of kinesio tape and oral motor therapy in group B was more effective in reducing drooling and the social impact while simultaneously improving the mouth closure.

The previous studies done by Mikami et al. and Pervez for kinesio tape over the orbicularis oris muscle in children proved the effectiveness of the tape in reducing drooling [11,12]. The result of the present study for using kinesiotape correlates with the above mentioned studies.

The mechanism of improving drooling by kinesio tape is that it enhances the sensory inputs of the orbicularis oris which will further benefit the motor skills of the muscle. Also, the kinesio tape has been used for the stabilization of the temporomandibular joint for decreasing the impact of drooling and improving the closure of the lips. However, the reason behind choosing orbicularis oris is that children with neurological impairment are found to have improper posture of the neck and head leading to continuous opening of the mouth. This can cause an overstretching of the muscle hence leading to drooling. Thus by improving the proprioceptive input and resultant muscle activity in orbicularis oris through kinesio tape, a beneficial effect on drooling could have been achieved.

Previous study done by the Mikami et al. proved the immediate beneficial effect of kinesio tape over the orbicularis oris muscle for the management of drooling by aiming to decrease the interlabial gap for measuring lip closure pre and post analysis [11]. However, the present study aimed to see the long term measurement of lip closure with the application of KT over the orbicularis oris every alternative day. Parents/Guardians of the subjects were detained from the intentional removal of the tape. With the deliberation that opening of the lips leads to drooling in neurologically impaired children along with impaired sensory stimulation, the application of kinesio tape would diminish the drooling by enhancing the lip closure. Studies have proved the beneficial effect of KT with the provision of improving tactile and proprioceptive receptors in the skin along with sensory stimulation [12,13]. This happens due to continuous propulsive action of KT over the skin surface activating the mechanoreceptors which could possibly improve the neuromuscular and proprioceptive function. Although, in the present study the unsubstantial measurement of lip closure after taping was observed before each application of kinesio tape, the results have come out to be beneficial.

Thus, the present study presumes the application of kinesio tape in improving the mechanoreceptors which further gives an explanation of reducing the mouth opening and drooling remarked in the present study samples.

Oral Motor Therapy (OMT) for the management of drooling and dysphagia have been widely used as a conventional form of treatment in children up to 18 years of age [2,14,15]. In the current study, the conventional treatment in both the groups for controlling drooling is the passive form of Oral Motor Therapy (OMT). The rationale behind using the passive the passive method of therapy is the age criteria of the sample children and their inability to follow the command for active oral motor therapy due to neurological impairment.

The beneficial effect of using oral motor therapy correlates with the previous study done by Raj Kumar et al. and is also described in the literature review done by Sjogreen et al. [2,14]. Correspondingly, the present study uses the oral motor therapy for groups A and B and exclusive oral motor for group A. Though statistically lesser improvement was seen in group A as compared to group B, the subjects in group A also showed significant improvement in all the three scales used for the measurement of drooling and has shown the significant reduction for the social impact points taken from the Drooling Impact Scale.

The rationale behind using the oral motor stimulation in the passive form is that of improving the sensory awareness, increasing blood circulation to the area, enhancing the flexibility of the muscle and the joint which could have helped in obtaining the favorable results to the therapy. Also, the tactile stimulation, administration of cold/ice to the orbicularis oris muscle is expecting to increase the sensory awareness.

In the previous studies, it has been mentioned that oral motor therapy neutralizes the feeding abnormalities and eases the muscular tone [16].

Also, both the treatment protocol has statistically beneficial effect over the impact of social stigma faced by the parents/guardians of the subjects.

The sample size in the present study included total 30 children with neurological impairment dividing equally in two groups. Group A subjects received conventional Oral Motor Intervention whereas group B subjects were treated by an adjunct kinesio tape along with oral

motor exercise. Children presented with the complaint of drooling due to neurological impairment having intermingled sensory processing from the mechanoreceptors of the body. All the children in the sample population showed improper tone of orbicularis oris, impaired position of head and neck, and inadequate lip closure.

The current study examined the effect of oral motor therapy and kinesio tape application as an adjunct protocol. The assessment was done pre, post 1st week, 2nd week, 3rd week and 4th week of intervention. Almost all the children in the study population removed the tape prior to the required time or even immediately in one of the sample. The application of kinesio tape on was very less than without kinesio tape. It has been described in a study that the cause of drooling in children with neurological impairment is not due to hyper salivation but rather the result of improper sensory awareness and poor postural alignment. Thus, leading to continuous opening of the mouth and dribbling of saliva. Therefore, application of kinesio tape is believed to trigger the proprioceptive input and initiating the lip closure. Whereas, Oral Motor therapy upgrades the muscular tone of orbicularis oris and enhances the swallowing of saliva with the treatment. Therefore, combined effect of both the protocols may give an explanation of achieving drooling control in the subjects of the present study.

The Drooling Impact Scale describes the quality of life and the aspect of social stigma faced by care givers or parents of the child with profuse drooling and therefore is assessed using this scale by the caregiver itself [17].

The severity and frequency of drooling was assessed using Thomas-Stonell Drooling Scale during the treatment. The result of the scale in present study correlates with the study evaluated for kinesio tape and speech therapy [11].

After 2nd week of intervention, decrease in drooling was seen as estimated by the scales used. Lip closure was the least changeable parameter due to unavoidable removal of tape by the children intentionally or through the continuous wetting of tape by the saliva.

Conclusion

From the observation of the current study it can be concluded that the application of kinesio taping on orbicularis oris muscle for the lip closure along with oral motor therapy has proved to be significantly effective in reducing the drooling in children with neurological impairment.

Oral Motor stimulation was proved to be significantly beneficial in reducing the frequency and severity of drooling in neurologically impaired children.

Time efficient treatment for the controlling drooling was statistically significant in intervention using kinesio tape and oral motor therapy. Also, the quality of life of the children was also improved with the above intervention protocol.

Application of kinesio tape has been proved to be significantly beneficial in increasing the mouth closure.

Both the interventions given in the current study were equally effective in reducing social stigma in neurologically impaired children as there was no statistically significant difference found between the groups.

Limitations

- Limitation of the study is the less compliance of children to the kinesio tape over the orbicularis oris. Either the children remove the tape unnecessarily or it gets off due to dribbling of saliva especially over the lower lip.
- Another limitation is the small sample size and lack of follow up.

Future Scope

Use of kinesio tape over the upper trapezius to control the postural misalignment of head and neck.

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