The Egyptian Journal of Hospital Medicine (April 2023) Vol. 91, Page 4462-4467

# Kinesio Taping Versus Oromotor Training on Drooling in Children with Spastic Cerebral Palsy: Comparative Study

**Hagar Mohamed Awaad*, Maya G. Aly, Hebatallah Mohamed Kamal**
Department of Pediatrics Physical Therapy, Faculty of Physical Therapy, Cairo University, Giza, Egypt
***Corresponding author:** Hagar Mohamed, **Mobile:** (+20)1030773968, **E-mail:** Hagarawaad730@cu.edu.eg

## ABSTRACT

**Background:** Children with cerebral palsy (CP) frequently have sustained drooling, which leads to feeding difficulties and social affection. Oral motor (OM) exercises and kinesio taping (KT) are treatment options described for management of drooling.

**Objective:** The aim of the current work was to compare between the effectiveness of KT versus OM training for improving drooling in children with spastic CP.

**Patients and Methods:** This study included 24 children of both gender with spastic CP, aged 4 to 8 years. They were selected according to specific eligibility criteria and were randomly allocated into Kinesio taping (KT) group (n=12) and oromotor (OM) group (n=12). The KT group received Kinesio taping application on orbicularis oris muscle, while the OM group received oral motor exercise program. Both groups received intervention 3 times/week for successive 2 months. Assessment of drooling severity and frequency by using the 5-minute drooling quotient (DQ) and drooling severity and frequency scale (DSFS). Data were collected at the baseline and the end of intervention. Data were statistically analyzed and compared.

**Results:** Comparison of pre- and post-treatment mean values of all measured variables showed significant improvement for children of both KT and OM groups. The post treatment results showed that OM training is more effective than KT in decreasing drooling severity and frequency.

**Conclusion:** Although both OM exercises and KT application are effective in improving drooling in children with spastic CP; OM training is proven to be more effective than KT when used as a standalone treatment.

**Keywords:** CP, Drooling, Kinesio Taping, Oro motor, Oral motor Exercises.

## INTRODUCTION

The most prevalent physical impairment in children is cerebral palsy (CP). It is described as a collection of movement impairments brought on by an anomaly or non-progressive lesion in the developing brain [(1)]. Oral motor disorders as feeding delays, oral secretion management, and phonological and articulation delayed development are all common. This occurs as a result of sensory, neuromuscular, and postural control deficits [(2)].

Sialorrhea, another name for drooling, is the unintended loss of saliva from the mouth. Children older than four are deemed to have pathologic chronic drooling or excessive salivation. The documented prevalence of persistent drooling in children is 0.5%, but in individuals with neurological diseases, especially those with cerebral palsy, the rate jumps to 60%. Many physically and psychologically debilitating problems, such as social isolation and low self-esteem, can be brought on by severe sialorrhea [(3, 4)].

Children with neurodisabilities are more likely to drool for a variety of reasons, including lower awareness of drooling, less frequent and ineffective swallowing, and oral sensory abnormalities, which can be made worse by posture disorders or reflux. This intricacy is further increased by the existence of contributory variables, such as the frequent use of drooling-inducing drugs by children with disabilities. Drooling is a multifaceted habit with many underlying causes, demanding the knowledge of a multidisciplinary team. While there is disagreement on the efficacy of various therapies, they can be used to treat drooling in children with disabilities. Botulinum neurotoxin A, surgery, and the use of drugs are intrusive treatments; behavioural, oral motor therapies, and the use of equipment are less invasive ones [(5)].

The goal of oral motor therapy is to influence the physiological support of the oral-pharyngeal process and thereby enhance its functions. This is accomplished by innervating sensory nerves for precise movement of the mouth contents (lips, jaw, tongue, soft palate, and larynx) and respiratory muscles. Examples of oral-motor exercises include stretching, active exercises, passive workouts, and sensory nerve stimulation [(6, 7)].

Drooling is linked to lip position in children with CP, hence KT treatment to the orbicularis oris muscle was shown to lower the interlabial gap, which in turn reduced drooling. KT is said to elevate the skin, enhancing blood flow and lymphatic drainage, which relieves pain [(8)].

The present literature lacks the evidence about the best intervention for treatment of drooling in children with CP. This study was aimed to find which intervention is more effective for these cases by comparing between the effectiveness of KT versus OM training on drooling.

## PATIENTS AND METHODS

This randomized clinical trial study included a total of 24 children of both gender with spastic CP, aged 4 to 8 years, selected from children referred to Pediatric Outpatient Clinic, Department of Pediatrics



Received: 16/11/2022
Accepted: 18/01/2023

Physical Therapy, Faculty of Physical Therapy, Cairo University.

This study was conducted between April and November 2022.

**Inclusion Criteria:**

Thirty-nine children with drooling were assessed, but only twenty-four of them met the inclusion criteria: Spastic CP, aged 4 to 8 years old, significant drooling on the drooling severity and frequency scale, with strong head control.

**Exclusion Criteria:**

Congenital disorders of the mouth and soft palate, such as cleft lip and palate, jaw anomalies, and salivary gland diseases; epilepsy; child taking medicines that may alter saliva production or other therapies to prevent drooling soon before or during the research Reactions to KT that are allergic.

The 24 children were randomly allocated into the two equal groups, 12 each; **group A (KT group) and group B (OM group)** as illustrated in the flow chart of the study **Figure (1).**

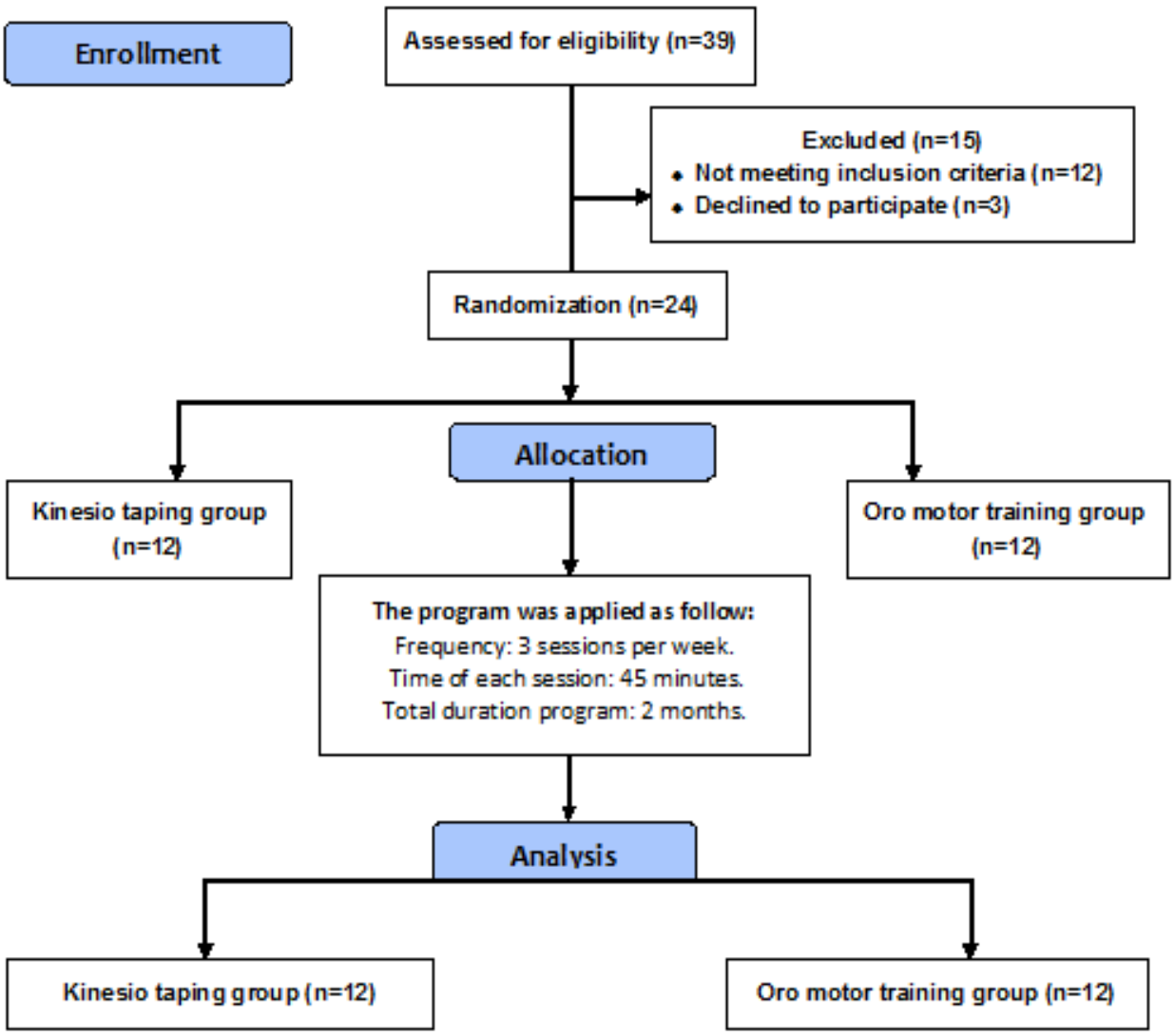


**Figure (1): Flow chart of the study.**

## PROCEDURES

### A-Procedures for Evaluation:

Evaluation of the measured outcomes was done at baseline (pre-treatment) and after 2 months of intervention (post-treatment). Drooling severity and frequency were assessed by the following measures:

***I-Drooling Severity and Frequency Scale (DSFS)***

The scale assesses the severity and frequency of saliva based on observation or information provided by the caregiver. Higher scores indicate worse drooling status. The severity part is scored on a scale of 1 to 5, and the frequency section is scored on a scale of 1-4 [(9)].

***II-Drooling Quotient five minute (DQ)***

An objective direct observational technique that counts the number of drooling episodes that occur during two observation sessions.[10]

### B- Procedure for Treatment

Intervention of each group was applied for 45 minutes; 3 sessions/week for 2 successive months.

**Group A (KT group):** Children in this group received KT on the orbicularis oris muscle. Taping application procedure was according to **Mikami *et al.*** [(8)].

- The skin covering the orbicularis muscle area was cleaned with cotton wool dipped in 70% alcohol.
- The distance between the corners of the mouth and the philtrum was used to calculate the width and height of each bandage.
- The therapist cut two elastic bandages to these dimensions and applied them with maximum stretch (one on each lip, top and bottom) (figure 2).

**Figure (2): Application of kinesiotape on upper lip and lower lip.**

**Group B (OM group):** Children in this group received selected OM training exercises according to **Bavikatte *et al.*** [(11)]**.**

• **Position of the child:** from sitting on supported chair.

• **Perioral sensory stimulation**: Sensory stimulation was applied on the cheeks, lips and jaw slowly compressed to stimulate the superficial and deep cutaneous receptors.

• **Tapping:** Rhythmic tapping was applied to cheeks on outer side of upper and lower gums, and over the upper and lower lip, to improve oral awareness.

• **Tongue pressure**: Gentle pressure using tongue depressor to the center of the tongue and to both sides gently.

• **Jaw exercises:** Including jaw opening, side to side movement and circular movement.

• **Intraoral stimulation:** Applied to the gums, tongue and palate. Massage was applied to gum, tongue and palate using tooth brush.

• **Training with different sizes of straws**: Beginning with a large diameter straw and a slightly thickened liquid, as the oral function improves reduce the straw diameter and increase the fluid thickness.

### Ethical Considerations:

**The study protocol was approved by the Faculty of Physical Therapy Ethics Committee, Cairo University, Egypt (No: P.T.REC/012/003677) and filed on ClinicalTrials.gov (with ID number: NCT05524831). Before their children took part in this study, written informed consent of all the participants' parents was obtained. The study protocol conformed to the Helsinki Declaration, the ethical norm of the World Medical Association for human testing.**

### *Statistical Analysis*

SPSS version 25 for Windows was used for all statistical analyses (IBM SPSS, Chicago, IL, USA). To compare the ages of the groups, an unpaired t-test was employed. To compare the diagnoses, spasticity levels, and gender distributions between groups, the Chi-squared test was used. Mann–Whitney Drooling Quotient and Drooling Severity and Frequency Scales The Wilcoxon signed ranks test was used to evaluate pre- and post-treatment comparisons, and the U test was utilised to compare the 5 Minute median values across groups. All statistical tests have a p-value of 0.05 as their significance threshold.

## RESULTS

### - Subject characteristics:

Twenty-four children with spastic CP with drooling participated in this study. **Table (1)** shows the subject characteristics of group A (KT group) and B (OM group). There was no significant difference between groups regarding age, sex, spasticity grades and diagnosis distribution ($p > 0.05$).

**Table (1): Comparison of subject characteristics between group A (KT group) and group B (OM group)**

| | Group A | Group B | Statistics | p-value |
|---|---|---|---|---|
| | Mean ± SD | Mean ± SD | | |
| **Age (years)** | 6.32 ± 1.63 | 5.9 ± 1.78 | t = 0.55 | 0.55 |
| **Sex, n (%)** | | | | |
| **Girls** | 3 (25%) | 4 (33.3%) | $\chi^2 = 0.2$ | 0.65 |
| **Boys** | 9 (75%) | 8 (66.7%) | | |
| **Spasticity, n (%)** | | | | |
| **Grade 1** | 4 (33.3%) | 7 (58.3%) | | |
| **Grade 1+** | 3 (25%) | 2 (16.7%) | $\chi^2 = 1.52$ | 0.46 |
| **Grade 2** | 5 (41.7%) | 3 (25%) | | |
| **Diagnosis, n (%)** | | | | |
| **Diplegia** | 9 (75%) | 9 (75%) | $\chi^2 = 0$ | 1 |
| **Quadriplegia** | 3 (25%) | 3 (25%) | | |

**Effect of Interventions on Drooling Severity and Frequency:**

***Within group comparison***

The Drooling Severity and Frequency Scale and Drooling Quotient in groups A and B were significantly lower five minutes after treatment compared to pre-treatment ($p > 0.01$).

***Between Groups Comparison***

Pre-treatment, there was no discernible difference between the groups ($p > 0.05$). After treatment, a comparison between the groups showed that group B (OM group) had significantly lower Drooling Severity and Frequency Scale and Drooling Quotient 5-minute values than group A (KT group) ($p > 0.05$) **(Table 2).**

**Table (2): Median values of Drooling Severity and Frequency Scale and Drooling Quotient 5-minute pre- and post-treatment of group A (KT group) and group B (OM group)**

| | Group A | Group B | | |
|---|---|---|---|---|
| | Median (IQR) | Median (IQR) | U- value | p-value |
| **Drooling severity scale** | | | | |
| **Pre-treatment** | 4 (4-4) | 4 (4-4) | 72 | 1 |
| **Post-treatment** | 3 (4-3) | 2 (3.75-1) | 35.5 | 0.02 |
| **Z-value** | -2.64 | -2.70 | | |
| | **p = 0.008** | **p = 0.007** | | |
| **Drooling frequency scale** | | | | |
| **Pre-treatment** | 4 (4-4) | 4 (4-3) | 60 | 0.35 |
| **Post-treatment** | 3 (3-3) | 2 (3-1) | 24 | 0.001 |
| **Z-value** | -3.16 | **-3.11** | | |
| | **p = 0.002** | **p = 0.002** | | |
| **Drooling quotient 5 minute** | | | | |
| **Pre-treatment** | 28.75 (50-17.5) | 26.25 (55-15.62) | 70.5 | 0.73 |
| **Post-treatment** | 21.25 (36.87-10 | 7.5 (19.37-0) | 34.5 | 0.03 |
| **Z-value** | -3.08 | -3.06 | | |
| | **p = 0.002** | **p = 0.002** | | |

IQR=Interquartile range; p-value=probability value, U-value=Mann-Whitney test value; Z- value=Wilcoxon signed ranks test value.

## DISCUSSION

Literatures lack the evidence about the best intervention for treatment of drooling in children with CP [12]. The present study was designed to compare between the effectiveness of KT versus OM training for improving drooling in children with spastic CP. Drooling occurs naturally in children up to the age of 36 months, but it is regarded as abnormal behavior beyond 4 years of age [13].

The present study included children with spastic CP as it is the most prevalent neurological condition and the spastic type is the most common motor type in about 90% of patients with CP(14). Spastic diplegia affects 35% of children with CP, quadriplegia affects 20% of children and spastic hemiplegia affects 25% [15]. CP is linked to drooling in young children. Drooling is a symptom of a neuromuscular control system for swallowing that is out of balance, causing too much saliva to accumulate in the anterior mouth and to drain out of the mouth without the patient's conscious agreement [16].

Drooling is a sign of poor tongue control. It can be a complicated issue, involving a lack of intra-oral feeling as well as head posture and control. Because it focuses on ideal posture for children in order to support head control and oral sensorimotor processes, which are essential elements in drooling [17].

Drooling can be managed clinically using the DSFS, which has been demonstrated to be a rapid and accurate measure of drooling. This is especially true for patients who are unable to complete the drooling quotient evaluation [10]. The DQ enables the therapist to assess how frequently sialorrhea occurs in children with developmental difficulties [3]. Many studies used DSFS and DQ to assess drooling severity and frequency in children with disability [18-20].

The results of this study demonstrated the efficacy of both therapies in reducing drooling in children with spastic CP, as significant changes between pre- and post-treatment mean values were seen among groups of children in both study groups. These findings strengthen the previous investigations by **Mikami *et al.*** [8] and **Pervez *et al.*** [21] who reported that the most effective way to stop toddlers from drooling was to apply KT to the orbicularis oris muscle. Also, **Caneschi *et al.*** [22] found that application of KT elastic bandage in the suprahyoid musculature for 30 days reduced drooling in children with neurological disorder.

Although the exact mechanism of action of KT is uncertain, it is believed to elevate the skin, thus improving lymphatic and blood flow. The sensory motor cortex, among other areas of the brain, is likely to see changes in activity as a result of taping. Studies show that the KT method provides tactile-proprioceptive stimulation that aligns the muscular fascia and provides sensory input that may hinder or aid the movement of the muscles [8].

Comparison between post-treatment values between the two study groups revealed that OM group was more effective than KT group in decreasing drooling severity and frequency. According to **Lof and Watson** [23] tongue elevation, tongue strength, lip strength, jaw stabilization, lateral tongue motions, lip and tongue protrusion, and drooling control were some of the advantages of OM exercises. Massage to the gums, on the other hand, gave sensory information for children to raise their awareness of saliva and swallowing frequency, hence contributing to a reduction in drooling severity[17]. **Kumar *et al.*** [24] reported a significant reduction in drooling and improving of chewing following OM exercises in children with CP. **Rekha *et al.*** [25] also revealed a significant decrease in drooling by using DQ in 25 children with CP after OM stimulation. Drooling was linked to lip position in children with CP, so it made sense that decreasing inter-labial space given by KT would lessen drooling. The inter labial gap was immediately reduced after the orbicularis oris muscle was taped.

On the other hand, **Inal *et al.*** [26] employed DSFS to assess the severity and frequency of drooling in children with CP; they reported no improvement in the drooling severity and frequency in the group received traditional OM exercises. It was justified by focusing mainly on training isolated muscle movements, including out of mouth practice active and passive range of motion and strength for lips and tongue, but not focusing on the optimal posture for the child and lack of oral sensory stimulation.

**Awan *et al.*** [27] found that drooling severity were reduced more significantly in the group that received combined intervention of KT plus OM exercises than in the other group that received KT alone in 48 CP children with age range from 4 to 8 years old and assessment occurred by using (DSFS). In a recent study, **Mokhlesin *et al.*** [28] looked at how KT training added to OM training affected drooling in kids with intellectual disabilities. The research group underwent regular OM training along with KT of the orbicularis oris, supra-hyoid, and masseter muscles, whereas the control group underwent fictitious OM training. After four weeks of intervention, the DQ test and drooling rating scale were used to conduct a pre-post evaluation. According to the findings, adding KT to OM training can lead to higher improvement than OM training combined with sham taping. The use of KT as an additional treatment to OM exercise may give more benefits for children with drooling problems.

## CONCLUSION

Although both OM exercises and KT application are effective in improving drooling in children with spastic CP; OM training is proven to be more effective than KT when used as a standalone treatment. So, it is recommended to use OM training as a first option of treatment and KT may be added to achieve more improvement for children with drooling problems.

**Supporting and sponsoring financially:** Nil.
**Competing interests:** Nil.

## REFERENCES

1. **Baxter P, Morris C, Rosenbaum P *et al.* (2007):** The definition and classification of cerebral palsy. Dev Med Child Neurol., 49(109): 1-44.
2. **Becher J (2002):** Pediatric rehabilitation in children with cerebral palsy: general management, classification of motor disorders. Journal of Prosthetics and Orthotics, 14(4): 143-9.
3. **Sforza E, Onesimo R, Leoni C *et al.* (2022):** Drooling outcome measures in paediatric disability: a systematic review. European Journal of Pediatrics, 181(7):2575-92.
4. **Riva A, Amadori E, Vari M *et al.* (2022):** Impact and management of drooling in children with neurological disorders: an Italian Delphi consensus. Italian Journal of Pediatrics, 48(1):1-6.
5. **McInerney M, Reddihough D, Carding P *et al.* (2019):** Behavioural interventions to treat drooling in children with neurodisability: a systematic review. Developmental Medicine & Child Neurology, 61(1):39-48.
6. **Swati Y (2019):** Effect of Kinesiotape as an Adjunct to Oral Motor Therapy on Drooling in Children with Neurological Impairment. Journal of Physiotherapy & Physical Rehabilitation, 4(2):1–6.
7. **El Nagar R, AL-Nemr A, Abdelazeim F (2021):** Effect of oromotor exercises on feeding in children with cerebral palsy: systematic review. Bulletin of Faculty of Physical Therapy, 26: 35. https://doi.org/10.1186/s43161-021-00054-8
8. **Mikami D, Furia C, Welker A (2019):** Addition of Kinesio Taping of the orbicularis oris muscles to speech therapy rapidly improves drooling in children with neurological disorders. Developmental Neurorehabilitation, 22(1):13-8.
9. **Genç G, Atalar M (2023):** Reliability and Validity Study of a Turkish Version of the Sialorrhea Clinical Scale for Parkinson's Disease (SCS-TR). Noro-Psikyatri Arsivi., 60(1):49-54.
10. **Rashnoo P, Daniel S (2015):** Drooling quantification: correlation of different techniques. International Journal of Pediatric Otorhinolaryngology, 79(8):1201-5.
11. **Bavikatte G, Sit P, Hassoon A (2012):** Management of drooling of saliva. Br J Med Pract., 5(1): 1-6.
12. **Walshe M, Smith M, Pennington L (2012):** Interventions for drooling in children with cerebral palsy. doi: 10.1002/14651858.CD008624.pub3.
13. **Chen T, Daniel S (2021):** Is bib count an accurate quantitative measure of drooling?. International Journal of Pediatric Otorhinolaryngology, 143:110657. doi: 10.1016/j.ijporl.2021.110657.
14. **Reid S, McCutcheon J, Reddihough D *et al.* (2012):** Prevalence and predictors of drooling in 7-to 14-year-old children with cerebral palsy: a population study. Developmental Medicine & Child Neurology, 54(11):1032-6.
15. **Patel D, Neelakantan M, Pandher K *et al.* (2020):** Cerebral palsy in children: a clinical overview. Translational Pediatrics, 9(1): 125-35.
16. **Xiong W, Cheng L, Tang G *et al.* (2021):** Acupuncture for drooling in children with cerebral palsy: A protocol for systematic review. Medicine, 100(14): e25393. doi: 10.1097/MD.0000000000025393
17. **Fairhurst C, Cockerill H (2011):** Management of drooling in children. Archives of Disease in Childhood-Education and Practice, 96(1):25-30.
18. **Parr J, Todhunter E, Pennington L *et al.* (2018):** Drooling Reduction Intervention randomised trial (DRI): comparing the efficacy and acceptability of hyoscine patches and glycopyrronium liquid on drooling in children with neurodisability. Archives of Disease in Childhood, 103(4):371-6.
19. **Calim O, Hassouna H, Yildirim Y *et al.* (2019):** Pediatric sialorrhea: submandibular duct rerouting and intraparotid botulinum toxin a injection with literature review. Annals of Otology, Rhinology & Laryngology, 128(2):104-12.
20. **Russo E, Calabrò R, Sale P *et al.* (2019):** Can muscle vibration be the future in the treatment of cerebral palsy-related drooling? A feasibility study. International Journal of Medical Sciences, 16(11):1447–52.
21. **Pervez R, Butt AK, Tabassum N (2014):** Effectiveness of Kinesiologic Taping Therapy in Drooling Management among Children with Cerebral Palsy. Journal Riphah College of Rehabilitation Sciences, 2(1):12-17.
22. **Caneschi W, Paiva C, Frade R *et al.* (2014):** Use of elastic bandage associated with speech therapy in the control ofsialorrhea (hypersalivation). Revista CEFAC., 16: 1558-66.
23. **Lof G, Watson M (2008):** A nationwide survey of nonspeech oral motor exercise use: Implications for evidence-based practice. Lang Speech Hear Serv Sch., 39(3):392-407.
24. **Kumar R, Varma A, Kumar V (2015):** Role of oromotor therapy in drooling child attending ENT department. IOSR J Dent Med Sci., 14(8):9-13.
25. **Rekha M, Juliet V (2016):** Effect of oral motor stimulation on drooling among children with cerebral palsy at selected centres in Coimbatore. DOI: https://doi.org/10.37628/ijpn.v2i1.138
26. **Inal Ö, Serel Arslan S, Demir N *et al.* (2017):** Effect of functional chewing training on tongue thrust and drooling in children with cerebral palsy: a randomised controlled trial. Journal of Oral Rehabilitation, 44(11):843-9.
27. **Awan W, Aftab A, Janua U *et al.* (2017):** Effectiveness of kinesio taping with Oro motor exercises in improving drooling among children with cerebral palsy: soi: 21-2017/re-trjvol01iss02p21. The Rehabilitation Journal, 1(02):21-7.
28. **Mokhlesin M, Mirmohammadkhani M, Tohidast S (2022):** The effect of Kinesio Taping on drooling in children with intellectual disability: A double-blind randomized controlled study. International Journal of Pediatric Otorhinolaryngology, 153:111017. doi: 10.1016/j.ijporl.2021.111017.