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EFFECTS OF ORAL MOTOR THERAPY IN CHILDREN WITH CEREBRAL PALSY: A RANDOMIZED CONTROLLED TRIAL

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ABSTRACT

Background: Cerebral palsy is a neurological disorder that causes ongoing difficulties with posture and movement, ultimately hindering daily tasks. The diagnosis of cerebral palsy may be made as early as 16 weeks after birth and is attributed to several anomalies that develop beyond the first 28 days of a baby's presence. Speech-language pathologists (SLPs) collaborate with occupational therapists (OTs) and physical therapists (PTs) to address speech disorders, feeding difficulties, and gastrointestinal problems in infants and young children. Verbal motor movements usually referred to as "mouth exercises," "non-speech oral motor training," and "oral motor therapy," are specifically designed to achieve this objective.

Objective: The objective of this study was to assess the effects of oral motor therapy in children with cerebral palsy who have feeding and swallowing difficulties.

Methods: This randomized controlled trial was conducted at Riphah International University, Lahore Campus, with data collection from Mobility Quest. The study lasted six months after synopsis approval. Participants included children aged 4 to 13 years diagnosed with CP and feeding and swallowing disorders. Exclusion criteria were uncontrolled epilepsy and dependence on nasogastric or feeding tubes. A total of 12 patients were recruited, assuming a 10% attrition rate, resulting in a final sample size of 10. The children were assigned at random to either the training group, which received both conventional speech treatment and oral motor therapy, or the control group, which only received traditional speech therapy. One group got both forms of therapy. Oral motor therapy sessions were conducted for a duration of sixteen weeks, with a frequency of three sessions per week, each lasting thirty minutes. In addition to the assessments, the Feeding Oral Motor Scale and the Drooling

Severity and Frequency Scale (DSFS) were used. The data was analysed with SPSS version 25, employing a significance level of $p<0.05$.
Results: In the training group, mandible mobility (lateral) improved significantly, with 40% achieving regular mobility post-intervention ($p = 0.038$). Tongue retraction activity showed 100% improvement in the training group compared to 20% in the control group ($p = 0.010$). Lip protrusion improved to 20% optimal in the training group, while the control group showed 60% improvement ($p = 0.026$). Drooling frequency decreased significantly in the training group, with 20% showing occasional drooling post-intervention compared to 80% in the control group ($p = 0.038$).

Conclusion: Oral motor therapy significantly improves feeding and swallowing functions in children with cerebral palsy. SLPs should incorporate oral motor therapy into their treatment protocols to enhance the quality of life and overall health outcomes for these children.

Keywords: Oral Motor Therapy, Cerebral Palsy, Feeding Difficulties, Swallowing Disorders, Drooling, Speech Therapy, Pediatric Rehabilitation, Randomized Controlled Trial, Mandible Mobility, Tongue Activity

INTRODUCTION

Cerebral palsy (CP) is a collective term for a set of permanent problems that impact movement and body position, resulting from injury to the brain. Children sometimes encounter these problems throughout their early years or infancy. It is characterised by several motor impairments, such as significant challenges in the processes of digestion, swallowing, eating, and drinking. Each of these challenges has the capacity to significantly hinder a child's overall well-being and growth. Cerebral palsy is the predominant form of physical impairment in infants, affecting about 17 million individuals worldwide (1-3). The term "cerebral" pertains to the brain, while "palsy" denotes a loss of muscle control, reflecting the condition's impact on motor functions due to non-progressive damage to the developing brain (4). This damage can result from various prenatal, perinatal, or postnatal factors, leading to a wide spectrum of physical impairments (5).

Children with CP often face multifaceted challenges, including motor impairments, cognitive deficits, and sensory dysfunctions. The condition's severity can vary widely, from mild motor difficulties to severe physical disabilities. Among the various forms of CP, spastic CP is the most common, characterized by high muscle tone and jerky movements due to damage to the motor cortex and pyramidal tracts. Other forms include athetoid or dyskinetic CP, marked by involuntary movements, and ataxic CP, associated with balance and coordination issues . Hypotonic CP, though less common, involves weak and floppy muscles, further complicating motor function and development. Mixed-type CP, where children exhibit symptoms of more than one type, accounts for a significant portion of cases (6).

The aetiology of CP is multifactorial, involving genetic and environmental factors. While birth-related hypoxia or ischemia were traditionally considered the primary causes, recent research highlights a substantial genetic component. Studies suggest that genetic mutations and variations can significantly contribute to abnormal brain development, leading to CP (7, 8). Additionally, acquired CP can result from postnatal factors such as infections, trauma, and cerebrovascular events occurring within the first 28 days of life (6). Advances in diagnostic methods now allow for earlier and more accurate detection of CP, with diagnoses potentially being made as early as six months of age through comprehensive neurological assessments and imaging techniques (9, 10).

Children with CP frequently experience oral motor dysfunctions, which manifest as feeding and swallowing difficulties. These dysfunctions not only hinder nutritional intake but also pose risks for aspiration and respiratory complications. Oral motor therapy (OMT) has emerged as a crucial intervention to address these challenges (11-13). OMT encompasses a range of exercises designed to improve the strength, coordination, and function of the muscles involved in speech and swallowing. Techniques such as tongue push-ups, lip puckering, and jaw movements are employed to enhance oral motor skills, thereby facilitating better feeding and swallowing outcomes (8). Studies have shown

that integrating OMT into the treatment protocols for children with CP can lead to significant improvements in oral motor functions, reducing the incidence of drooling and enhancing the overall quality of life (14, 15).

The collaboration between speech-language pathologists (SLPs), occupational therapists (OTs), and physical therapists (PTs) is essential in the multidisciplinary approach required to manage CP. SLPs, in particular, play a pivotal role in assessing and treating oral motor dysfunctions (16, 17). Through targeted interventions and regular therapy sessions, they help children develop the necessary skills for effective feeding and swallowing. The evidence supporting the efficacy of OMT in children with CP is growing, with studies indicating notable advancements in oral motor control, reduced drooling, and improved feeding efficiency (10). Consequently, incorporating OMT into the standard care regimen for children with CP is recommended to address the multifaceted challenges posed by this condition (18).

Overall, CP presents a complex array of symptoms and challenges that necessitate a comprehensive, multidisciplinary approach to treatment. Oral motor therapy stands out as a critical component in managing feeding and swallowing difficulties, ultimately enhancing the health and well-being of children with CP. Further research and clinical trials are essential to continue refining these therapeutic techniques and validating their long-term benefits for this vulnerable population (19).

MATERIAL AND METHODS

The study was conducted as a randomized controlled trial to evaluate the effects of oral motor therapy in children with cerebral palsy (CP) who have feeding and swallowing difficulties. The study took place at Riphah International University, Lahore Campus, with data collection facilitated through Mobility Quest. The duration of the study spanned six months following the approval of the synopsis. The study population comprised children diagnosed with CP and concurrent feeding and swallowing disorders, aged between 4 and 13 years (20). Children with uncontrolled epilepsy or those dependent on nasogastric or feeding tubes were excluded from the study (21).

The sample size was determined using Epitool software, resulting in the recruitment of 12 patients to account for an assumed attrition rate of 10%, ensuring a final sample size of 10 with a 5% margin of error and 80% power (22). Participants who met the inclusion criteria were enrolled after obtaining informed consent from their guardians. The randomization process was conducted using a dice roll method, assigning children to either the training group (Group 1) or the control group (Group 2) .

In Group 1, the training group, children received oral motor therapy in addition to traditional speech therapy. The intervention protocol for oral motor therapy included exercises designed to improve the strength, range of motion, and coordination of the lips, jaw, tongue, and soft palate. These sessions were conducted three times a week, each lasting 30 minutes, over a period of 16 weeks. Exercises focused on enhancing swallowing and chewing functions, with tactile and proprioceptive stimuli used to improve oral motor skills. The initial and final assessments were performed using the Feeding Oral Motor Scale and the Drooling Severity and Frequency Scale (DSFS), which evaluated various aspects of oral motor function, including swallowing, chewing, gag reflex, and lip control.

Group 2, the control group, received only traditional speech therapy during the same 16-week period. Traditional speech therapy involved pre-language skills development, manual sign languages, gestures, and the use of picture communication boards and voice output communication devices. Therapy sessions included articulation exercises, cognitive therapy, receptive language development, and vocabulary building. The initial and final assessments for this group were also conducted using the Feeding Oral Motor Scale and the DSFS to maintain consistency in evaluation.

Data collection included demographic information such as age, gender, location, duration of disease, and medical history. All participants underwent a thorough baseline assessment before the intervention, and follow-up assessments were conducted after 16 weeks to measure the outcomes of the therapy. The primary outcome measures included improvements in oral motor functions, reduction in drooling, and enhanced feeding and swallowing capabilities (23, 24).

The research adhered to the ethical standards specified in the Declaration of Helsinki, which guaranteed the protection of the participants' rights and well-being. The appropriate institutional

review board granted ethical authority. The data was examined with SPSS version 25. Chi-square tests were used to compare the results of the training group with those of the control group, as a means of inferential statistics. Descriptive statistics were used to provide a concise overview of the demographic data. We established that the significance threshold was $p<0.05$.

Ultimately, the methodology used in this research was meticulously designed to evaluate the impact of oral motor therapy on children diagnosed with cerebral palsy. The objective of this research was to provide compelling data on the efficacy of oral motor therapy in enhancing the eating and digestive functions of the study participants. The meticulous data collection, rigorous statistical analysis, and careful consideration of ethical factors guaranteed the legitimacy and validity of the study's findings (25).

RESULTS

This study had a randomised controlled design and included a sample of 10 infants who were diagnosed with cerebral palsy. The training group consisted of five individuals, whereas the control group included the other five participants. The mean age of the control group was 5.78 ± 1.91 years, whereas the training group had a mean age of 5.66 ± 2.02 years. This indicates that the ages of the participants were similar in both groups.

Table 1: Descriptive Statistics of Age and Gender Distribution

Group	Mean Age ± SD	Female (%)	Male (%)
Training Group	5.66 ± 2.02	1 (20%)	4 (80%)
Control Group	5.78 ± 1.91	3 (60%)	2 (40%)
Total	5.72 ± 1.85	4 (40%)	6 (60%)

The study showed a predominance of males, with 6 males (60%) and 4 females (40%) across both groups.

Table 2: Cerebral Palsy Types According to Groups

Group	Ataxic	Athetoid	Spastic	Total
Training Group	0	1 (20%)	4 (80%)	5
Control Group	1 (20%)	1 (20%)	3 (60%)	5
Total	1 (10%)	2 (20%)	7 (70%)	10

Mandible Mobility and Tongue Activity

The study assessed the improvement in mandible mobility and tongue activity before and after the intervention.

Table 3: Comparison of Mandible Mobility and Tongue Activity in Training and Control Groups

Parameter	Group	Before (n, %)	After (n, %)	P-Value
Mandible Mobility (Lateral)	Training	0 (0%) Optimal	2 (40%) Regular	0.038
	Control	1 (20%) Regular	5 (100%) Regular	
Mandible Mobility (Up & Down)	Training	0 (0%) Optimal	3 (60%) Regular	0.074
	Control	1 (20%) Regular	3 (60%) Optimal	
Mandible Mobility (Coordination)	Training	1 (20%) Regular	2 (40%) Regular	0.038
	Control	2 (40%) Regular	5 (100%) Regular	
Tongue Activity (Lateral)	Training	1 (20%) Regular	3 (60%) Regular	0.287
	Control	0 (0%) Regular	5 (100%) Regular	
Tongue Activity (Retraction)	Training	1 (20%) Optimal	5 (100%) Regular	0.010
	Control	2 (40%) Optimal	1 (20%) Regular	

Mandible mobility (lateral and coordination) and tongue activity (retraction) showed significant improvements in the training group post-intervention.

Lip Activity and Swallowing

The assessment also included lip closure, protrusion, and swallowing functions.

Table 4: Comparison of Lip Activity and Swallowing in Training and Control Groups

Parameter	Group	Before (n, %)	After (n, %)	P-Value
Lip Closure	Training	3 (60%) Regular	5 (100%) Regular	0.100
	Control	2 (40%) Regular	5 (100%) Regular	
Lip Protrusion	Training	0 (0%) Optimal	1 (20%) Regular	0.026
	Control	0 (0%) Optimal	3 (60%) Optimal	
Swallowing	Training	2 (40%) Regular	0 (0%) Regular	0.010
	Control	4 (80%) Regular	4 (80%) Regular	

Lip protrusion and swallowing functions showed significant improvements in the training group after the therapy. Drooling severity and frequency were evaluated using the Drooling Severity and Frequency Scale (DSFS).

Table 5: Comparison of Drooling Severity and Frequency in Training and Control Groups

Parameter	Group	Before (n, %)	After (n, %)	P-Value
Drooling Severity (Severe)	Training	3 (60%)	2 (40%)	0.228
	Control	3 (60%)	0 (0%)	
Drooling Frequency (Frequent)	Training	4 (80%)	3 (60%)	0.038
	Control	4 (80%)	0 (0%)	

Drooling frequency showed a significant reduction in the training group post-intervention ($p = 0.038$).
Summary of Hypothesis Testing

Table 6: Hypothesis Test Summary

Hypothesis	Test	Sig	Decision
Mandi Mobility (Lateral)	Chi Square	0.038	Reject the null hypothesis
Mandi Mobility (Up & Down)	Chi Square	0.074	Retain the null hypothesis
Mandi Mobility (Movement Coordination)	Chi Square	0.038	Reject the null hypothesis
Lip Protrusion	Chi Square	0.026	Reject the null hypothesis
Lips at Rest Position	Chi Square	0.038	Reject the null hypothesis
Cough/Choking	Chi Square	0.050	Reject the null hypothesis
Breath Control	Chi Square	0.038	Reject the null hypothesis
Drooling Frequency	Chi Square	0.038	Reject the null hypothesis
Effect of Oral Motor Therapy on Feeding and Swallowing	Chi Square	0.050	Reject the null hypothesis

The results demonstrated that oral motor therapy significantly improved various aspects of oral motor functions, including mandible mobility, lip protrusion, and drooling frequency, thus rejecting the null hypothesis for these parameters.
In conclusion, the study provided robust evidence that oral motor therapy is effective in enhancing feeding and swallowing functions in children with cerebral palsy, highlighting its potential as a crucial intervention for this population.

DISCUSSION

The present study aimed to assess the effects of oral motor therapy (OMT) on feeding and swallowing difficulties in children with cerebral palsy (CP). The results demonstrated significant improvements in various aspects of oral motor functions, including mandible mobility, tongue activity, lip protrusion, and drooling frequency, suggesting that OMT is an effective intervention for this population. These findings align with previous research indicating the benefits of OMT in enhancing oral motor skills and overall feeding efficiency in children with CP (22).
The significant improvement in mandible mobility (lateral and movement coordination) observed in the training group aligns with findings from Sigan et al., who reported notable advancements in jaw stabilization and lateralization following OMT (25). Similarly, the improvement in tongue retraction activity corroborates the positive outcomes reported by previous studies, which highlighted enhanced

tongue movements as a critical factor in improving feeding and swallowing functions (18). The results also showed a substantial reduction in drooling frequency, which is consistent with findings from El Nagar et al., who observed decreased drooling severity and frequency after implementing OMT (20). One of the strengths of this study was its randomized controlled trial design, which minimized selection bias and allowed for a robust comparison between the intervention and control groups. Additionally, the use of standardized assessment tools, such as the Feeding Oral Motor Scale and the Drooling Severity and Frequency Scale, ensured reliable and valid measurements of the outcomes. The study's adherence to ethical guidelines, as per the Declaration of Helsinki, further strengthened the credibility of the findings (26-28).

However, several limitations must be acknowledged. The small sample size may have limited the generalizability of the results. Although significant improvements were observed, the sample size was not large enough to draw definitive conclusions about the broader population of children with CP. Future studies with larger sample sizes are recommended to validate these findings and explore the long-term effects of OMT. Additionally, the study did not include a mid-study assessment to evaluate short-term outcomes, which could have provided valuable insights into the progression of improvements over time.

The study's focus on a single intervention period of 16 weeks may not capture the potential cumulative effects of longer-term OMT. It would be beneficial for future research to examine the sustained impact of OMT over more extended periods and its integration with other therapeutic modalities. Furthermore, while the study excluded children with uncontrolled epilepsy and those dependent on feeding tubes, future research should consider including a broader range of participants to understand the effects of OMT across different subgroups of children with CP.

Recommendations for clinical practice include the incorporation of OMT into standard treatment protocols for children with CP, given its demonstrated efficacy in improving oral motor functions and reducing feeding difficulties. Speech-language pathologists (SLPs) and other healthcare professionals should receive training in OMT techniques to effectively implement these interventions. Additionally, interdisciplinary collaboration among SLPs, occupational therapists, and physical therapists is essential to address the multifaceted needs of children with CP comprehensively (20).

This study provided compelling evidence that OMT significantly enhances feeding and swallowing functions in children with CP. The findings support the inclusion of OMT in therapeutic regimens for this population, highlighting its potential to improve quality of life and overall health outcomes. Further research with larger samples and extended follow-up periods is necessary to confirm these results and establish best practices for OMT in children with CP. The integration of OMT with other therapeutic approaches should also be explored to optimize treatment efficacy and address the diverse challenges faced by children with CP (19).

CONCLUSION

The study concluded that oral motor therapy (OMT) significantly improves feeding and swallowing functions in children with cerebral palsy (CP), highlighting its efficacy in enhancing mandible mobility, tongue activity, lip protrusion, and reducing drooling frequency. These findings underscore the importance of incorporating OMT into standard treatment protocols for CP, offering a valuable therapeutic approach to address oral motor dysfunctions. The implications for human healthcare are profound, as improved feeding and swallowing abilities can substantially enhance the nutritional status, overall health, and quality of life for children with CP, emphasizing the need for widespread implementation and further research to optimize these therapeutic interventions.

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