Effect of Oral Motor Facilitation Technique on Oral Motor and Feeding Skills in Children with Cerebral Palsy: A Case study

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Research Article

Keywords: Cerebral palsy, Oral motor facilitation technique, Oral motor function, Oral motor exercise, Oral motor therapy

Posted Date: May 31st, 2022

DOI: https://doi.org/10.21203/rs.3.rs-1687232/v1

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Abstract

Background: Deficiencies in oral motor and feeding skills are common in children with cerebral palsy (CP). Oral motor therapy is a useful method to improve oral motor skills and feeding skills. The oral motor facilitation technique (OMFT) is a newly designed oral motor therapy that includes postural control, sensory adaptation, breathing control, sensorimotor facilitation, and direct feeding.

Methods: This study was performed to determine the effect of OMFT on oral motor and feeding skills in children with CP. A total of 21 children with CP (3–10 years, GMFCS III–V) participated in 16 sessions of OMFT for 30 min, once a week for 16 weeks. The effects on oral motor and feeding skills were assessed using the Oral Motor Assessment Scale (OMAS) before as well as 8 and 16 weeks after treatment. Data were analyzed using the Friedman test and post-hoc analysis.

Results: The results showed a significant improvement in oral motor skills and feeding skills, including mouth closure, lip closure on the utensil, lip closure during deglutition, control of the food during swallowing, mastication, straw suction, and control of liquid during deglutition after OMFT. Mouth closure was the most effective and mastication was the least effective item. Both the post-training periods of 8 and 16 weeks were effective, with the latter being more effective than the former.

Conclusions: The results suggest that OMFT is an extremely effective and useful oral motor therapy protocol to improve oral motor function in children with CP.

Background

Cerebral palsy (CP) describes a group of sensory, cognitive, motor, and movement disorders caused by non-progressive development or immature infant brain lesions[1]. Feeding disorders are very common in CP, with oral motor problems as the major causes [2, 3]. The prevalence of oral motor problems is 68–90% [4, 5]. Symptoms of oral motor problems in CP include difficulties and disorders associated with efficient, safe sucking and swallowing, suck-swallow-breath control, oral motor and oral structure function, solid food transition, various textured bolus control, and drooling control[5–11].

The comprehensive activities of oral motor function include basic oral structure movement with postural control, sensory and oral sensorimotor function, motor control, and motor learning[1, 7, 8, 11, 12]. Oral motor function is an essential part of eating, swallowing, and communication[13, 14]. Oral motor function affects the feeding skills, nutrition, and QOL of both children and caregivers[15]. Thus, oral motor therapy in CP is considered a useful method for improving oral motor function and feeding and swallowing skills[15–19].

Oral motor therapy is defined as any activity performed to improve oral motor and oropharyngeal function by postural control, sensory stimulation, oral structure, breathing, and muscle movement[16, 18]. Comprehensive oral motor therapy requires complex aspects, such as direct manual stroking, passive sensory stimulation, and active oral motor exercise[16, 18]. Many prior studies have verified the positive
effects of various types of oral motor therapy on oral motor function, swallowing, and feeding function on CP[10, 15, 17]. However, oral motor therapy in previous studies had several limitations, including the provision of simple sensory stimulation, focusing on specific oral structures, and providing oral motor therapy to CP with moderate dysphagia[10,15.17.20].

Min et al.[18, 21] designed the oral motor facilitation technique (OMFT) to overcome these limitations and provide comprehensive approaches. OMFT is based on brain neural plasticity, systematic oral motor therapy protocol to facilitate oral motor function, planning, and oral praxis through postural control, sensorimotor facilitation, voluntary participation, motor control, and motor learning[18, 21]. The OMFT comprises a warm-up technique, key point technique, and application technique. The OMFT includes 10 categories and 50 techniques[21]. The warm-up technique consists of 2 categories and 12 techniques, including sensory and treatment adaptation, postural control, and breathing control. The key point technique is composed of 7 categories and 30 techniques, including direct manual stroking on oral structure for lip closure, tongue movement, and chewing facilitation. The application technique consists of 1 category and 8 techniques, including direct food control and items supporting chewing and swallowing. The OMFT comprises nine basic concepts, namely oral adaptation, oral awareness, sensory stimulation, proprioceptive activation, breathing control, neural facilitation, structural elongation, muscular strengthening, and voluntary exercise[18]. OMFT is applied manually, and thus has high fidelity. OMFT is suitable for patients who cannot participate actively owing to a lack of consciousness as well as infants and toddlers. OMFT can be customized by individual functions, from basic sensory stimulation to real food processes.

Thus, this study aimed to investigate the effectiveness of OMFT, a newly designed comprehensive oral motor treatment protocol, on oral motor function in CP using a standardized oral motor assessment tool.

Methods

Participants

A total of 21 CP patients (16 boys, 5 girls) with dysphagia, aged 3–10 years, participated in this study. All participants were diagnosed with moderated-to-severe motor disorders (GMFCS I–V), with spastic quadriplegia being the most common (16). Following were the inclusion criteria: scores below 10 in baseline OMAS, participation in more than 80% of the whole process, no experience of OMFT, children with head and neck control problems, and audible, visible perceptual deficiency. The exclusion criteria were as follows: children with seizures, oral structure problems, tube feeding, and aspiration.

Procedures

Participants received 16 sessions of OMFT for 4 months. OMAS was assessed before as well as 8 and 16 weeks after OMFT. The first author, an occupational therapist who participated in developing the OMFT, carried out all the processes.
Outcome Measures

The Oral Motor Assessment Scale (OMAS) is a standardized oral motor assessment tool used to assess oral motor problems in CP[22]. It tests seven oral motor function and oral motor performance function items related to feeding, by directly observing children's mealtime. These items include mouth closure, lip closure on the utensil, lip closure during deglutition, control of the food during swallowing, mastication, straw suction, and control of liquids during deglutition. Each item takes 30 s to test, and is graded on a scale from 0–3, where 0 = passive, 1 = subfunctional, 2 = semi-functional, and 3 = functional, with a higher score indicating high oral motor function. OMAS can be assessed by directly observing the perioral muscles at mealtime, without requiring additional participation and following directions. Inter-rater reliability was defined as Kappa > 0.85, and intra-rater reliability was defined as Kappa > 0.90. Validation was performed by comparison with typically developing children. The assessment was performed in a quiet and barrier-free dysphagia therapy room. The participants sat in a feeder seat to support the trunk and head. The researcher asked the caregivers (all the children's mothers) to feed their child in the following order: soft, hard, liquid food with the usual device and method.

Treatment Protocol

OMFT was provided in the following order: warming up technique, key point technique, application technique, with the researcher's direct manual stroking. Details of the treatment are as follows: 1) warming up technique: postural control of the face and neck, nasal breathing facilitation, sensory adaptation, and awareness; 2) key point technique: oral structure facilitation and chewing; and 3) application technique: real food control. The treatment was performed in a quiet and barrier-free dysphagia therapy room. The participants sat in a feeder seat to support the trunk and head. Treatment was provided individually, depending on the oral function and development level of the participants.

Statistical Analysis

Results were analyzed using the Window SPSS ver. 25. Differences among periods of OMFT were analyzed using the Friedman test, and the significance level (α) was set at $P < 0.05$. If the difference was significant, the Wilcoxon signed-rank test was used to determine the effect of different periods of OMFT. To lower the type I error probability, the significance level (α) was modified to 0.017 (0.05/3) by Bonferroni correction.

Results

Study Participants

The participants included 15 boys (71.4%) and 6 girls (28.6%), with an average age of 5.88 (SD = 1.98). GMFCS level was I (7, 14.3%; II, 33.3%; III, 52.4%). Most of them had spastic quadriplegia (16/21; 76.2%)
Table 1
Demographic characteristics of the participants

| Variables                      | n  | %   |
|-------------------------------|----|-----|
| Gender                        |    |     |
| Male                          | 15 | 71.4|
| Female                        |  6 | 28.6|
| Gestational age (weeks)       |    |     |
| Average (M ± SD)              | 35.24 ± 3.52 |
| Range                        |  30–40|
| Age at assessment (years)     |    |     |
| 3–4                           | 10 | 48.7|
| 5–6                           |  6 | 28.6|
| 7–8                           |  3 | 14.3|
| 9–10                          |  2 |  9.6|
| Average (M ± SD)              |  5.88 ± 1.98 |
| Range                        |  3.2–10.3|
| GMFCS                         |    |     |
| Level 3                       |  3 | 14.3|
| Level 7                       |  7 | 33.3|
| Level 11                      | 11 | 52.4|
| Primary motor type            |    |     |
| Spastic                       | 16 | 76.2|
| Dyskinetic                    |  4 | 19.1|
| Mixed                         |  1 |  4.8|
| Motor distribution            |    |     |
| Quadriplegia                  | 16 | 76.2|
| Diplegia                      |  5 | 23.8|

GMFCS: Gross Motor Function Classification System

**Effect On Oral Motor Function**

Every item of the OMAS significantly improved after 16 weeks (Table 2), with significant differences in oral motor skills between the periods. In the post hoc analysis, all items changed significantly. Between 8 and 16 weeks, mouth closure, straw suction, and total score improved significantly (Figs. 1 and 2). The treatment effect was evaluated based on the difference in the average score between baseline and 16 weeks post-treatment assessment; mouth closure had the highest percentage (0.76), followed by straw sucking (0.62) and mastication (0.43).
Table 2
Effect of OMFT on oral motor and feeding skills

| OMAS                          | Assessment stage | Mean (SD) | Mean rank | Friedman | Post hoc analysis |
|-------------------------------|------------------|-----------|-----------|----------|-------------------|
|                               |                  |           |           | χ²       | Assessment stage | z       | p        |
| Mouth closure                 |                  |           |           |          |                   |         |          |
|                              | 1                | 1.14 ± 0.57 | 1.40      | 24.13    | 0.000*            | -3.00   | 0.003**  |
|                              | 2                | 1.57 ± 0.60 | 2.05      |          |                   | -2.65   | 0.008**  |
|                              | 3                | 1.90 ± 0.70 | 2.55      |          |                   | -4.00   | 0.000**  |
| Lip closure on the utensil    |                  |           |           |          |                   |         |          |
|                              | 1                | 1.00 ± 0.63 | 1.45      | 21.57    | 0.000*            | -3.00   | 0.003**  |
|                              | 2                | 1.43 ± 0.81 | 2.10      |          |                   | -2.24   | 0.025    |
|                              | 3                | 1.67 ± 0.86 | 2.45      |          |                   | -3.74   | 0.000**  |
| Lip closure during deglutition|                  |           |           |          |                   |         |          |
|                              | 1                | 0.86 ± 0.73 | 1.55      | 16.72    | 0.000*            | -2.53   | 0.011**  |
|                              | 2                | 1.24 ± 0.70 | 2.10      |          |                   | -1.89   | 0.059    |
|                              | 3                | 1.48 ± 0.87 | 2.36      |          |                   | -3.13   | 0.002**  |
| Control of the food during swallowing | |           |           |          |                   |         |          |
|                              | 1                | 1.14 ± 0.47 | 1.50      | 15.70    | 0.000*            | -2.50   | 0.013**  |
|                              | 2                | 1.57 ± 0.60 | 2.12      |          |                   | -2.00   | 0.046    |
|                              | 3                | 1.76 ± 0.70 | 2.38      |          |                   | -3.15   | 0.002**  |
| Mastication                   |                  |           |           |          |                   |         |          |
|                              | 1                | 0.90 ± 0.30 | 1.60      | 16.22    | 0.000*            | -2.83   | 0.005**  |
|                              | 2                | 1.29 ± 0.56 | 2.17      |          |                   | -1.00   | 0.317    |
|                              | 3                | 1.33 ± 0.58 | 2.24      |          |                   | -3.00   | 0.003**  |
| Straw suction                 |                  |           |           |          |                   |         |          |
|                              | 1                | 0.29 ± 0.46 | 1.60      | 18.89    | 0.000*            | -2.24   | 0.025    |
|                              | 2                | 0.52 ± 0.68 | 1.93      |          |                   | -2.83   | 0.005**  |
| OMAS                        | Assessment stage | Mean (SD)     | Mean rank | Friedman | Post hoc analysis |
|-----------------------------|------------------|---------------|-----------|----------|------------------|
|                             |                  |               |           | $\chi^2$ | $P$              | $z$      | $p$     |
|                             | ⬤                | 0.90 ± 0.77   | 2.48      |           |                  | -3.67   | 0.001** |
| Control of liquids during deglutition | ⬤                | 0.67 ± 0.48   | 1.52      | 18.57    | 0.000*           | -3.00   | 0.003** |
|                             | ⬤                | 1.10 ± 0.54   | 2.12      |           |                  | -1.89   | 0.059   |
|                             | ⬤                | 1.33 ± 0.73   | 2.36      |           |                  | -3.13   | 0.002** |
| Total                       | ⬤                | 6.00 ± 2.59   | 1.02      | 38.71    | 0.000*           | -3.94   | 0.000** |
|                             | ⬤                | 8.71 ± 3.40   | 2.14      |           |                  | -3.33   | 0.001** |
|                             | ⬤                | 10.38 ± 4.56  | 2.83      |           |                  | -4.02   | 0.000** |

- : baseline assessment, ⬤ : 8-week assessment, ⬤ : 16-week assessment

*Friedman $P<0.05$

**Post hoc analysis adjusted $P<0.017$

**Discussion**

Oral motor disorders are very common in patients with CP, and oral motor treatment is therefore essential. The results of this study indicate that OMFT is an effective method to enhance oral motor skills in patients with CP. The total OMAS score gradually increased from baseline (6.00 ± 2.59) and 8 weeks (8.71 ± 3.40) to 16 weeks (10.38 ± 4.56). Every item, including mouth closure, lip closure on the utensil, lip closure during deglutition, control of the food during swallowing, mastication, straw suction, and control of liquids during deglutition, was significantly different between the treatment periods. OMFT is thus a comprehensive oral motor therapy that includes various aspects such as postural control of the head and neck, nasal breathing, sensory adaptation and advance preparation, direct manual stroking on oral structures, and the process of real food.

In a study by Baghbadorani et al. (2014), 12 patients with CP participated in 8 weeks (24 sessions total) of oral motor therapy. All OMAS items improved; however, in post hoc analysis, only four items, including mouth closure, control of the food during swallowing, control of liquids during deglutition, and mastication, significantly changed between baseline and post-treatment assessment. Only four items, including control of food during swallowing, control of liquids during deglutition and mastication, and
total score, were significantly increased between the baseline and midterm assessment. In Gisel’s study (1994), spoon-feeding, biting, and chewing improved by 20 weeks but not by 10 weeks in the sensorimotor treatment group. This result may be attributed to the fact that the sensorimotor treatment group and chewing group were divided separately, and sensorimotor treatment was administered to specific oral structures. The authors of previous studies have stated that postural control and sensory and cognitive approaches should be considered together. Furthermore, qualified changes in oral motor skills were observed in the sensorimotor treatment group compared to the the chewing-only group. These findings suggest that comprehensive oral motor therapy may be more effective.

Based on the average difference from baseline and 16 weeks of OMFT, the treatment effect on mouth closure was the highest and mastication was the lowest. The highest item was mouth closure (1.33), which is in agreement with a previous study[15], while the lowest item was straw suction (0.32). Herein, mastication and straw suction were the two items with the lowest effect; both are high-level oral activities that require complex oral motor coordination, such as breathing control, oral motor control, swallowing timing, attention, and learning. Mastication involves a systematic sensorimotor combination of transfer of bolus to the molar side by the tongue, placing bolus between the tongue and cheek, safe and repetitive chewing and grinding, and moving the bolus to the back of the mouth[8, 12]. Straw drinking requires lip sealing around the straw with an outer bite, and the continuous sucking of liquid[17]. In Gisel’s study (1994), no improvement in straw drinking was observed, and the treatment effect result of this study (0.61) was two times higher than that reported in a previous study (0.32)[15], indicating that OMFT is more effective than classical oral motor treatment in straw sucking and drinking.

Participants in the former study were predominantly school-aged, with moderate dysphagia or problems in following directions[10, 15, 17]. In this study, the effect of OMFT on oral motor function was verified in children over 6 years of age (33.3%). Participants in this study may not have had any prior experience with systematic oral motor treatment, such as OMFT. Therefore, children beyond the critical age could be expected to significantly improve when providing opportunities for oral motor therapy. The effect of OMFT was found in children with audible, visible perceptive limitation, and difficulty in following directions owing to severe motor disorders.

In our study, we found that both 8 weeks and 16 weeks of OMFT were effective, although the longer treatment was more effective. This result is similar to the finding that 20 weeks is more effective than 10 weeks of OMFT in Gisel’s study (1994), while 8 weeks was more effective than 4 weeks in the study by Baghbadorani et al. (2014). Although all studies indicate that a longer treatment is beneficial, each period in the three studies was different. Therefore, additional research should be performed to accurately identify the most effective period. According to this study, at least 8 sessions of 8 weeks might be needed to enhance oral motor function, and the effective periods may depend on the development and function of children.

This study has certain limitations. First, our sample size was small (only 21). Furthermore, we did not enroll a control group; therefore, a comparison between OMFT and classical oral motor treatment and
other oral treatment methods was not possible. Premature, brain lesion disease, and head and neck cancer subjects have a high ratio; hence, studies should be performed in cases of various ages.

This study indicates that OMFT is an effective oral motor therapy protocol to improve oral motor function. Our results suggest that OMFT for at least 8 weeks is needed to improve the oral motor function of patients with CP, while 16 weeks of treatment is more effective. OMFT is effective for older children and patients who have limitations in perception and difficulties in following directions.

Conclusions

In this study, we investigated the effect of OMFT on oral motor function and feeding function in 3–10-year-old patients with CP with GMFCS level III–V. Both periods of 8 and 16 weeks were effective, while 16 weeks of treatment was more effective. OMFT is an effective oral motor treatment protocol for increasing oral motor function in patients with CP.

Abbreviations

OMAS
Oral motor assessment scale
OMFT
Oral Motor Facilitation Technique

Declarations

Ethics approval and consent to participate

Approval for the study was obtained from the ethics committee of the Institutional Review Board of Wonkwang University in Korea(WKIRB-202106-HR-035). All procedures in this study were performed in accordance with the ethical standards of the institutional and/or national research committees and the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Parents and/or legal guidance of all participants provided informed consent to participate in the study.

Consent for publication

Not Applicable.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests
The authors declare that they have no competing interests.

**Funding**

This study was supported by Wonkwang University (2021).

**Author's Contributions**

All authors contributed to the study conception and design. Oral Motor Function Technique was designed by all authors. KC made substantial contributions to the conception and design, acquisition and interpretation of data. SM made substantial contributions to revise the manuscript critically. HS made substantial contributions to revise the manuscript critically for important intellectual content and supervise all process. The first draft of the manuscript was written by KC and all authors reviewed the manuscript.

**Acknowledgements**

Not applicable

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**Figures**

![OMAS items comparison graph](image)

**Figure 1**

Post hoc analysis of OMAS items between periods of OMFT. Difference of every items between baseline and 16 weeks assessment was significant.

*Post hoc analysis adjusted for $P < 0.017$*
Figure 2

Post hoc analysis of total OMAS score between periods of OMFT. Difference between baseline, 8weeks and 16weeks assessment was significant.

*Post hoc analysis adjusted for $P < 0.017$