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Effectiveness Observation of Oral Motor Training Games in the Rehabilitation of Children with Articulation Disorders

Sun Guang [1], Liu Ying [2], Zhao Jing[3*], Song Yinping [4], Jiang Mingxia [5]

[1]The Third Affiliated Hospital of Jiamusi University, Heilongjiang Provincial Center for Prevention, Treatment, and Rehabilitation of Pediatric Cerebral Palsy, China;
2The Third Affiliated Hospital of Jiamusi University, Heilongjiang Provincial Center for Prevention, Treatment, and Rehabilitation of Pediatric Cerebral Palsy, China;
3The Third Affiliated Hospital of Jiamusi University, Heilongjiang Provincial Center for Prevention, Treatment, and Rehabilitation of Pediatric Cerebral Palsy, China;
4The Third Affiliated Hospital of Jiamusi University, Heilongjiang Provincial Center for Prevention, Treatment, and Rehabilitation of Pediatric Cerebral Palsy, China;
5The Third Affiliated Hospital of Jiamusi University, Heilongjiang Provincial Center for Prevention, Treatment, and Rehabilitation of Pediatric Cerebral Palsy, China;

Email: 295471182@qq.com 792690239@qq.com 80966012@qq.com songyinping1008@126.com 30343839@qq.com

Abstract: Oral motor training games provide a novel reference for rehabilitation in children with articulation disorders. This study investigates the application effects of this method. Sixty children undergoing rehabilitation for articulation disorders were randomly divided into an observation group and a control group. The control group received conventional rehabilitation interventions, while the observation group incorporated oral motor training games into the baseline protocol. Comparisons were made between the two groups regarding improvements in oral motor function and speech abilities. Results demonstrated that the observation group exhibited significantly higher scores in both oral motor function and speech function compared to the control group ($P < 0.05$)23. Compared to conventional methods, oral motor training games show distinct advantages in enhancing articulation abilities, oral motor coordination, and speech outcomes for children with articulation disorders56. These findings suggest that oral motor training games can serve as a scientifically validated and effective rehabilitation intervention, offering valuable insights for clinical practice in articulation disorder management.

Keywords: Oral Motor Training Games; Oral Motor Function; Speech Function

Introduction

Dysarthria is a speech disorder characterized by abnormal articulation resulting from functional impairments or diseases affecting the nervous system, muscles, and articulatory organs [1]. Children with dysarthria often exhibit symptoms such as difficulty in speaking, unclear articulation, poor speech fluency, abnormal voice quality, abnormal speech rate, abnormal vocal resonance, and fatigue in the articulatory muscles [2]. This condition not only reduces the intelligibility of a child's speech, affecting their normal communication abilities, but also undermines their self-confidence and self-esteem. Moreover, if not intervened in a timely and effective manner, it can lead to difficulties in the child's future learning, daily life, and employment, thereby reducing the quality of life for both the individual and their family [3].

Currently, interventions for children with dysarthria mainly include speech therapy, oral motor training, visual feedback, and multi-sensory integration therapy. Although these methods are effective in improving children's articulation abilities, they also present issues such as long treatment duration, poor child cooperation, a monotonous and unending intervention process, among others. Additionally, while family involvement and parental guidance can enhance treatment outcomes, they require a high level of professional knowledge and skills from parents, making them less universally applicable. In contrast, oral motor training games, by gaming the therapeutic process, can increase children's participation enthusiasm while enhancing the fun and interactivity of the treatment. This, in turn, better motivates the children to participate actively, ensuring and improving the effectiveness of the intervention. Moreover, it is convenient and quick for parents to master these games, ensuring the continuity of the intervention method. In light of this, our hospital has conducted a study on the application of oral motor training games in the rehabilitation of children with dysarthria [4].

Literature Review

Dysarthria, a speech disorder characterized by abnormal articulation due to functional impairments or diseases affecting the nervous system, muscles, and articulatory organs, poses significant challenges to affected children's communication

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abilities and psychosocial well-being. Children with dysarthria often experience difficulties in articulating words clearly, maintaining speech fluency, and producing normal voice quality, which can adversely impact their self-confidence and social interactions. If left untreated or inadequately managed, dysarthria can lead to long-term difficulties in learning, daily life, and employment, thereby reducing the quality of life for both the individual and their family [5].

Various interventions have been employed to address dysarthria in children, including speech therapy, oral motor training, visual feedback, and multisensory integration therapy. These methods have demonstrated efficacy in improving children's articulation abilities to some extent. However, they also present several limitations. For instance, treatment durations are often lengthy, and children may exhibit poor cooperation due to the monotonous and unengaging nature of the intervention process. Additionally, the effectiveness of these interventions heavily relies on the child's motivation and ability to adhere to the treatment regimen, which can be challenging to sustain over time [6].

Furthermore, while family involvement and parental guidance are recognized as valuable components of dysarthria management, they require a high level of professional knowledge and skills from parents. This poses a barrier to widespread implementation, as not all families possess the necessary resources or expertise to effectively support their child's rehabilitation. [6]

In response to the limitations of traditional interventions, oral motor training games have emerged as a promising alternative. By gamifying the therapeutic process, these games aim to increase children's participation enthusiasm and enhance the fun and interactivity of the treatment. This approach not only better motivates children to engage actively in the intervention but also ensures and improves its effectiveness by making the learning process more enjoyable and less daunting. [7]

One of the key advantages of oral motor training games is their ability to cater to children's natural inclination towards play and exploration. By integrating therapeutic elements into engaging game scenarios, these games can capture children's attention and sustain their interest over extended periods. This, in turn, facilitates more consistent and effective practice of articulation skills, leading to improved speech outcomes. [8]

Moreover, oral motor training games offer a high degree of flexibility and adaptability. They can be tailored to meet the specific needs and abilities of individual children, allowing for personalized intervention plans. Additionally, parents can easily learn and administer these games at home, ensuring the continuity of the intervention and reducing the need for frequent visits to specialized clinics. [9]

Oral motor training games represent a promising approach to the rehabilitation of children with dysarthria. By leveraging the power of play and interactivity, these games offer a novel and effective means of improving children's articulation abilities and enhancing their overall communication skills. However, further research is needed to validate the long-term efficacy of these games and to explore their potential in combination with other therapeutic modalities. Additionally, efforts should be made to develop standardized protocols and guidelines for the use of oral motor training games in clinical practice, ensuring their safe and effective application across diverse populations of children with dysarthria. [10]

Description of the Study Area:

Sixty children with dysarthria who received rehabilitation treatment in our hospital from May 2022 to June 2023 were selected as the study subjects. The inclusion criteria for the children were as follows: ① they met the diagnostic criteria for dysarthria outlined in the Diagnostic and Statistical Manual of Mental Disorders (DSM) published by the American Psychiatric Association [4]; ② they were aged between 2 and 8 years old; ③ both the children and their family members spoke Mandarin Chinese; ④ there were no morphological or motor function abnormalities in their articulatory organs; ⑤ they had normal hearing; and ⑥ their dysarthria symptoms had persisted for more than 0.5 years. The exclusion criteria were: ① having developmental disorders; ② having neurological diseases; ③ having recently suffered from illnesses such as colds or fevers that could potentially affect articulation clarity; and ④ having abnormal hearing. For all children participating in the study, informed consent was obtained from their guardians, who signed the consent form.Using a random number table method, the patients were evenly divided into a control group and an observation group. In the control group, there were 22 males and 8 females, aged between 2 and 8 years old, with an average age of (4.01±1.47) years. In the observation group, there were 23 males and 7 females, aged between 2 and 6 years old, with an average age of (3.83±1.02) years. There were no significant differences in general characteristics between the two groups ($P>0.05$), making them comparable.The control group received conventional rehabilitation interventions, including guidance on tongue muscle movements, lip movements, breathing exercises, basic nursing care, and cognitive training. Each intervention session lasted for 30 minutes and was conducted continuously for 6 months.

The observation group engaged in oral motor training games:

① An animal sound imitation game. Children practiced articulation changes by imitating the sounds of different animals, such as dogs and cats, to enhance the flexibility and coordination of their oral muscles.

② An oral movement card game. Children flipped through cards depicting various oral movements, such as blowing, inhaling, and exhaling, and performed the corresponding actions to train their lip and tongue muscles.

③ A mouth expression game. Children imitated different facial expressions, such as smiling and pouting, of characters in pictures to exercise the coordination of their lip muscles and improve their control over oral muscles during articulation.

④ A phonological matching game. Children engaged in a game matching vowels and consonants to train the accuracy of their articulation and the fluency of their speech, as well as to increase their understanding of syllables and vocabulary.

The above games were conducted according to a progressive principle, with each game stage having different difficulty levels, gradually transitioning from basic oral movement training to more complex articulation and speech fluency

training to ensure that the children gradually improved their dysarthria abilities. The games incorporated a real-time feedback mechanism. For example, after a child completed a certain articulation action, the system or parents provided feedback, indicating whether the articulation was accurate and encouraging the child to continuously improve and adjust. Each game session encouraged the participation of both parents and children, with parents acting as facilitators to assist their children in completing the tasks within the games. The intervention period for the observation group was the same as that for the control group, with a treatment frequency of three times per week, each session lasting for 30 minutes, and continuous intervention for 6 months.

Comparison of Improvements in Oral Motor Function

This study compared the improvements in oral motor function between the two groups of children. According to the data presented in Table 1, before the intervention, there were no significant differences in the functional scores for oral sensation, mandible, lips, tongue, as well as the total functional score between the control group and the observation group, indicating that the initial conditions of the two groups were similar.

After the intervention, both groups demonstrated significantly higher scores in each functional category and the total functional score compared to before the intervention, suggesting that the intervention measures had a positive impact on improving the oral motor function of children in both groups. Simultaneously, the observation group showed significantly higher scores in oral sensation, mandible, lips, tongue functional scores, as well as the total functional score compared to the control group ($P < 0.05$). This indicates that the intervention method adopted by the observation group was more effective than that of the control group and could better promote the improvement of oral motor function in the children.

Group	Intervention Time	Oral Sensation	Mandible	Lips	Tongue	Total Score
Control Group (n=30)	Pre-intervention	7.23±1.25	17.97±1.22	15.97±1.10	42.07±1.74	83.30±2.97
	Post-intervention	9.10±1.21*	23.60±1.59*	18.63±1.73*	51.57±2.27*	110.83±4.09*
Observation Group (n=30)	Pre-intervention	7.27±1.23	17.80±1.22	15.73±0.91	41.43±2.14	83.07±2.69
Control Group (n=30)	Pre-intervention	10.97±1.30*#	27.30±1.77*#	24.10±1.47*#	55.77±1.43*#	126.33±2.40*#

Table 1: Comparison of Oral Motor Function Scores Between the Two Groups of Children (Points)

Note: "*" indicates a significant difference compared to pre-intervention ($P < 0.05$); "#" indicates a significant difference compared to the control group ($P < 0.05$).

Table 1 presents a comparison of oral motor function scores between two groups of children before and after an intervention. The control group and the observation group each consisted of 30 children.Before the intervention, there were no significant differences observed in the scores for oral sensation, mandible, lips, tongue, or the total score between the control group and the observation group. This indicates that the two groups were comparable in terms of their initial oral motor function status.For both the control group and the observation group, significant improvements were noted in all categories (oral sensation, mandible, lips, tongue) as well as in the total score after the intervention. This suggests that the intervention had a positive impact on enhancing the oral motor function of the children in both groups.Upon comparing the post-intervention scores between the two groups, it was evident that the observation group demonstrated significantly higher scores in all categories (oral sensation, mandible, lips, tongue) and the total score compared to the control group. This indicates that the intervention method employed in the observation group was more effective in improving oral motor function than the method used in the control group.The analysis of Table 1 suggests that while both interventions were beneficial in enhancing oral motor function, the specific intervention method utilized in the observation group led to greater improvements compared to the control group. This highlights the potential effectiveness of the observation group's intervention in promoting better oral motor function outcomes in children

Group	Intervention Time	Expressive Ability Score	Receptive Ability Score
Control Group (n=30)	Pre-intervention	50.37±7.27	43.93±9.15
	Post-intervention	56.67±5.73*	57.03±6.41*
Observation Group (n=30)	Pre-intervention	48.73±5.15	45.23±5.12
	Post-intervention	64.77±9.19*#	61.43±7.93*#

Table 2: Comparison of Speech Function Scores (Expressive and Receptive Abilities) Between the Two Groups of Children (%)

Note: "*" indicates a significant difference compared to pre-intervention (P＜0.05); "#" indicates a significant difference compared to the control group (P＜0.05).

This table presents a comparison of the expressive and receptive ability scores in speech function between the control group and the observation group of children before and after an intervention. The data reveals that both groups showed significant improvements in both expressive and receptive abilities after the intervention. However, the observation group demonstrated significantly higher scores in both categories compared to the control group post-intervention, suggesting that the intervention method used in the observation group was more effective in enhancing the children's speech function abilities.

Results and Discussion

Dysarthria is a common speech disorder in children, primarily characterized by unclear articulation and phonetic errors, which severely impact children's language expression, social skills, and self-confidence [7]. Although various intervention methods for dysarthria currently exist, there are still notable issues in their implementation. Firstly, many intervention approaches are highly specialized, such as speech therapy, oral motor training, and multisensory integration therapy, all of which require a high level of technical proficiency. Secondly, the intervention process often lacks趣味性 (fun and engaging elements), and the treatment duration is lengthy, which can easily lead to boredom or even resistance in children, thereby affecting the treatment outcomes. Additionally, children with dysarthria exhibit significant variations in their symptoms, yet current intervention programs lack sufficient personalized design to fully meet the needs of each individual child.

Oral motor training games integrate oral muscle training with gamified design, focusing on fun and interactivity to help children improve their articulation function in a relaxed environment [8]. The principle behind these games is to stimulate the muscle groups involved in articulation, such as those in the lips, tongue, and mandible, through game tasks, thereby enhancing muscle flexibility and coordination. Simultaneously, repeated training is utilized to strengthen children's control over oral movements. Visual and auditory feedback mechanisms within the games, such as animations, cards, and sound effects, assist children in adjusting their articulation movements in real-time and enhancing their self-monitoring abilities. Compared to traditional methods, oral motor training games are more engaging, not only attracting children to participate actively but also avoiding the monotony of the training process and improving treatment efficacy. Moreover, the flexible and diverse forms of these games allow for the design of personalized programs based on children's specific articulation issues, meeting different needs and making the treatment process more efficient and sustainable. This represents an innovative approach in the intervention of dysarthria.

Limitation of the Study

The study was conducted at a single rehabilitation center in China with a small sample size (N=60), which may limit the generalizability of findings to other populations (e.g., children with comorbid neurological conditions or those from diverse linguistic/cultural backgrounds).The 6-month intervention period precludes assessment of long-term retention effects. Future studies should include follow-up evaluations to determine whether improvements in oral motor function and speech abilities persist beyond the training phase.Therapists and parents were not blinded to group assignments, potentially introducing performance bias. For instance, heightened enthusiasm from caregivers in the observation group (games) may have influenced children’ s engagement.

Conclusion

This study demonstrates that, compared to conventional rehabilitation methods, oral motor training games exhibit significant advantages in improving articulation function. The analysis attributes this to the integration of oral muscle training with fun games in oral motor training games, which enhances children's initiative in participation and avoids the monotony of traditional methods. The progressive training and real-time feedback mechanisms in the games effectively strengthen children's control over oral muscles. Furthermore, the involvement of parents extends the training effects and further improves rehabilitation outcomes [9]. The study also reveals that oral motor training games significantly improve children's oral motor function and speech function, particularly outperforming the control group in terms of oral coordination, articulation accuracy, and language comprehension and expression abilities. The analysis attributes this to the multisensory stimulation and interactive tasks designed in the games, such as sound imitation and action cards, which systematically train the flexibility and strength of oral muscles while enhancing practical opportunities for language use within game contexts. The active participation of parents also provides children with richer language input and communication opportunities, further promoting the development of language function.

In conclusion, oral motor training games offer distinct advantages in the rehabilitation of children with dysarthria and play a positive role in their recovery.

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