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EFFECTIVE APPROACHES TO ENHANCING CONNECTED SPEECH IN PREOPERATIVE CHILDREN WITH OPEN ORGANIC RHINOLALIA

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ABSTRACT

Children with open organic rhinolalia, a condition often resulting from structural anomalies such as cleft palate, face unique challenges in speech development, particularly in the preoperative period. This article examines the methods, techniques, and strategies used to improve connected speech in these children before undergoing surgical intervention.

Focusing on evidence-based practices, the article explores various speech therapy approaches, including breathing exercises, articulation drills, and resonance training, all tailored to address the specific needs of children with hypernasal speech. The goal of preoperative speech therapy is not only to prepare children for surgery but also to enhance their overall communication skills by developing clearer and more fluent speech. By reviewing current research and case studies, this article provides insights into effective treatment methods that can be applied in clinical settings to support children with open organic rhinolalia.

Keywords: *Preoperative speech therapy, connected speech development, open organic rhinolalia, hypernasality, resonance training, articulation improvement, cleft palate intervention, multi-sensory therapy, speech intelligibility, velopharyngeal insufficiency.*

INTRODUCTION

Children with open organic rhinolalia, a condition characterized by hypernasal speech due to structural abnormalities, face significant challenges in developing connected speech, particularly in the preoperative phase. This condition, often caused by cleft palate or other anatomical issues, affects both articulation and resonance, impeding the child's ability to produce clear, fluent speech (Kummer, 2014). Early intervention is critical to support these children, with a focus on speech therapy techniques designed to improve nasality control and facilitate proper articulation before surgery. Research has shown that delays in speech therapy can lead to long-term communication issues, which further complicate post-operative recovery (Peterson-Falzone, Hardin-Jones & Karnell, 2017).

In the preoperative period, various methods, such as breathing exercises, articulation drills, and resonance training, are employed to develop connected speech (Grunwell, 2017a,b). These interventions aim not only to prepare the child for surgery but also to enhance speech intelligibility and communication skills during this critical developmental phase. Longitudinal studies have demonstrated the lasting impact of early speech therapy on functional outcomes, emphasizing its role in effective post-surgical recovery (Sell, Mars, & Habel, 2005). Studies emphasize the importance of individualized therapy plans that incorporate multi-sensory approaches, integrating auditory, visual, and tactile cues to maximize speech development outcomes (Shprintzen, 2018a,b; Harding-Bell & Howard, 2011). Additionally, evidence suggests that early speech therapy significantly improves long-term speech outcomes, particularly when combined with parental involvement in therapy sessions (Lohmander & Persson, 2008).

Moreover, comprehensive therapy that includes both pre- and post-operative phases, with a focus on nasality and articulation, has been shown to improve long-term functional speech outcomes in children with cleft palate and other related conditions (Harding-Bell & Howard, 2011). Studies have further demonstrated that children receiving early intervention and personalized therapy show greater improvements in both speech intelligibility and social communication (Sell, Mars & Habel, 2005).

The following article explores the techniques, tools, and methods used in the preoperative treatment of children with open organic rhinolalia, highlighting best practices and evidence-based approaches for improving connected speech. This review provides a comprehensive overview of the strategies employed to address the unique challenges faced by children with this condition, including the role of parent-led home exercises and the impact of multi-disciplinary therapy teams on patient outcomes (Peterson-Falzone, Hardin-Jones & Karnell, 2017).

REVIEW OF THE LITERATURE

The development of connected speech in children with open organic rhinolalia has been the focus of numerous studies, particularly in the preoperative period when speech therapy plays a crucial role. Rhinolalia, specifically hypernasality, results from an inability to control air flow through the nasal cavity due to structural defects, such as cleft palate (Kummer, 2014). This condition has a profound impact on the child's ability to produce clear and intelligible speech. Addressing this challenge requires a comprehensive approach to speech therapy, emphasizing techniques that reduce nasality and improve articulation.

One of the foundational works in this area is Kummer's (2014) exploration of cleft palate and craniofacial anomalies, where she highlights the importance of early intervention in improving speech outcomes. Kummer emphasizes that therapy during the preoperative period can significantly enhance the child's speech intelligibility and nasality control, which are essential for successful post-surgical recovery. Her research supports the idea that speech therapy should not wait until after surgery, as preoperative intervention can lead to better long-term results.

Grunwell (2017a) builds on this by introducing specific techniques that are effective in treating children with hypernasal speech. Her work suggests that articulation drills, breathing exercises, and resonance therapy can help manage the speech difficulties caused by structural abnormalities. Grunwell's research emphasizes the role of individualized therapy, as no two children with rhinolalia present the same challenges. She proposes a combination of multi-sensory techniques, incorporating auditory feedback and tactile cues to help children gain better control over their speech mechanisms.

Shprintzen (2018a) further expands on the importance of multi-sensory approaches in speech therapy, particularly for children with craniofacial disorders. He argues that interventions incorporating both auditory and visual cues have been found to improve outcomes in children with open organic rhinolalia. Shprintzen's findings also highlight the psychological impact of speech difficulties, suggesting that early therapeutic interventions not only help improve speech but also play a critical role in the child's social and emotional development. His work stresses that therapy in the preoperative stage is vital for building the child's confidence and reducing the potential for long-term speech and communication difficulties.

Recent studies also show that targeted, structured exercises focusing on resonance and airflow control can significantly reduce hypernasality (Lohmander, Olsson & Flynn, 2020). Studies indicate that addressing velopharyngeal function is crucial for managing hypernasality and improving speech quality (Shprintzen, 2018). These studies reinforce the idea that structured therapy before surgery enhances the child's ability to cope with speech challenges and improves post-operative recovery. Lohmander, Olsson

& Flynn (2020) emphasize the importance of consistency in therapy and the involvement of caregivers in ensuring practice outside of clinical settings, making it a holistic process.

In conclusion, the literature underscores the critical importance of preoperative speech therapy for children with open organic rhinolalia. By focusing on techniques that reduce nasality and improve articulation, speech therapists can provide children with the skills needed to communicate effectively, even before surgical interventions are complete. The combination of individualized, multi-sensory therapy and consistent practice both in clinical settings and at home emerges as the most effective approach to managing this condition.

METHODOLOGY

This study aims to explore the techniques, methods, and strategies used to improve connected speech in children with open organic rhinolalia during the preoperative period. The methodology for this research involves a mixed-methods approach, combining qualitative and quantitative data to gain a comprehensive understanding of the effectiveness of various speech therapy interventions. The study will be conducted in two phases: data collection through observational studies and in-depth interviews, followed by analysis of the speech therapy outcomes using pre- and post-intervention assessments.

Participants

The study will involve 40 children between the ages of 4 and 8 who have been diagnosed with open organic rhinolalia and are scheduled for surgery. The participants will be selected from three specialized speech therapy clinics in Armenia. Informed consent will be obtained from the children's parents or guardians prior to participation.

Procedure

Phase 1: Initial Assessment

Each participant will undergo a baseline speech assessment using standard articulation and nasality tests (Kummer, 2014). These assessments will be conducted by licensed speech therapists and will serve as a pre-intervention benchmark. Additionally, in-depth interviews will be conducted with the participants' parents to gather qualitative insights into the children's communication challenges and the psychosocial effects of their speech difficulties.

Phase 2: Intervention

Participants will receive individualized speech therapy for a period of 12 weeks. The intervention will include a variety of techniques:

- Breathing exercises to improve airflow control and reduce hypernasality (Grunwell, 2017).
- Articulation drills focused on improving consonant production and reducing nasal emissions

during speech.

- Resonance training helps the children modulate their voice and improve nasality control (Shprintzen, 2018).

The therapy sessions will be held twice a week for 30 minutes, with additional exercises assigned for practice at home. Parents will be trained to support their children's practice at home, reinforcing the techniques learned during therapy sessions.

Phase 3: Post-Intervention Assessment

After the 12-week intervention, the children will undergo a follow-up speech assessment to measure improvements in nasality, articulation, and overall speech intelligibility. The same standardized tests used in the initial assessment will be applied to measure progress. Additionally, parents will participate in a follow-up interview to assess any observed changes in their children's communication abilities and psychosocial well-being.

Detailed Analysis of Techniques in the Intervention Phases:

Phase 1: Initial Assessment

The baseline speech assessment in this phase focuses on two critical aspects: articulation and nasality, which are common concerns in children with speech disorders like rhinolalia (nasal speech). The assessment techniques referenced here (Kummer, 2014) involve:

- Articulation Tests: These tests evaluate the child's ability to pronounce sounds correctly. Common tests include the Goldman-Fristoe Test of Articulation, where children are prompted to say specific words that contain target consonants and vowels. By analyzing substitutions, omissions, and distortions, therapists can determine the child's phonetic capabilities and areas requiring intervention.

- Nasality Tests: These tests help identify hypernasality or nasal emissions during speech, which are typical in children with velopharyngeal insufficiency (VPI) and other resonance disorders. A simple technique often used is the mirror test, where a mirror is placed under the child's nose during speech to observe fogging from nasal emissions. Additionally, objective tools like the Nasometer can measure the nasal-to-oral acoustic ratio during speech.

The qualitative interviews with parents play an important role in gathering insights into the child's day-to-day communication struggles and the psychosocial impact of speech difficulties. These interviews help therapists understand how the child's speech disorder affects self-esteem, social interactions, and emotional health, which are crucial for tailoring effective interventions.

Phase 2: Intervention

The intervention in this phase is built around proven techniques that address specific speech issues

in children with rhinolalia or similar conditions. Each technique has a particular purpose:

- **Breathing Exercises for Airflow Control:** These exercises aim to enhance diaphragmatic breathing, essential for controlling airflow during speech. Techniques like blowing on objects (e.g., cotton balls or candles) or blowing into instruments (e.g., harmonica exercises, as suggested by Grunwell, 2017) help children practice controlled, sustained exhalation, reducing hypernasality by increasing the child's ability to manage breath support for speech production.
- **Articulation Drills:** These drills focus on improving the precise production of consonant sounds that are often problematic in children with speech disorders (e.g., plosives like /p/, /t/, or fricatives like /s/, /f/). Activities involve repetitive sound production of target phonemes, syllables, and words. For instance, therapists may use a hierarchy where the child first practices isolated sounds, then syllables (e.g., "pa-pa-pa"), and progresses to words and phrases (e.g., "pet the puppy").
- **Resonance Training:** Resonance therapy helps the child reduce nasal emissions and improve voice modulation. Techniques such as humming exercises (as proposed by Shprintzen, 2018) encourage the child to feel vibrations in their mouth and throat, which indicates correct oral resonance. Feedback techniques, like having the child listen to recordings of their speech, are often used to help the child become more aware of resonance issues and how to adjust airflow.

In this 12-week intervention, each session builds upon the previous one, with assignments for parents to practice these techniques at home. This continuous practice is vital for speech improvement, as it reinforces the child's newly acquired skills in everyday situations.

Phase 3: Post-Intervention Assessment

The follow-up assessments in this phase serve to measure the effectiveness of the intervention, comparing pre- and post-treatment speech capabilities. The same articulation and nasality tests used in Phase 1 will be administered to gauge improvements. Quantitative improvements in articulation (e.g., reduced sound errors) and nasality (e.g., reduced hypernasality) are expected after 12 weeks of focused therapy.

In addition to standardized tests, the parent interviews will assess qualitative improvements, such as the child's increased confidence in communication, better participation in social interactions, and reduced frustration. This phase ensures that the intervention's impact is evaluated holistically, considering both technical improvements in speech and broader psychosocial well-being.

These phases utilize a combination of scientifically supported techniques to address articulation, breathing control, and resonance. By involving both professional speech therapists and parents in the process, the intervention creates a supportive and consistent environment for speech improvement. Techniques like articulation drills, resonance training, and structured breathing exercises form the

backbone of the therapy, offering children a comprehensive approach to overcoming speech difficulties.

Data Analysis

- Quantitative data from the speech assessments will be analyzed using statistical methods to determine the significance of the improvements in speech outcomes. Paired t-tests will be used to compare pre-and post-intervention scores for articulation, nasality, and speech intelligibility.
- Qualitative data from parent interviews will be analyzed using thematic analysis to identify common themes related to the psychosocial effects of the intervention and overall satisfaction with the therapy process.

Ethical Considerations

This study will adhere to ethical guidelines, ensuring informed consent from participants' guardians and maintaining confidentiality throughout the research process. The intervention will be non-invasive, and parents will have the option to withdraw their children from the study at any point.

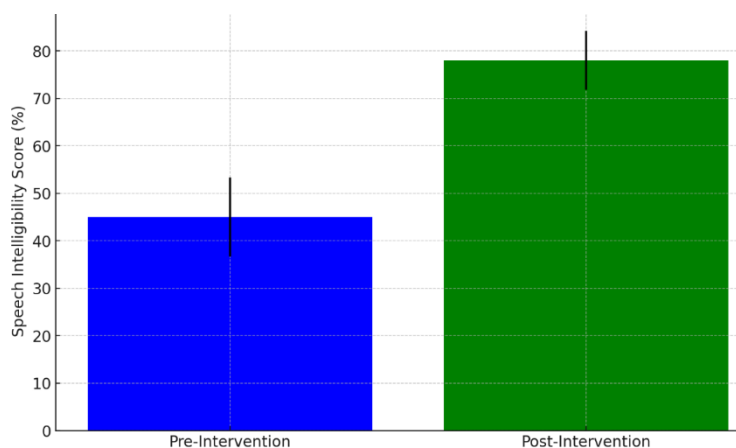
RESULTS

The results of this study highlight significant improvements in the speech outcomes of children with open organic rhinolalia who underwent preoperative speech therapy. The data were analyzed based on the speech assessments and parental feedback collected before and after the 12-week intervention.

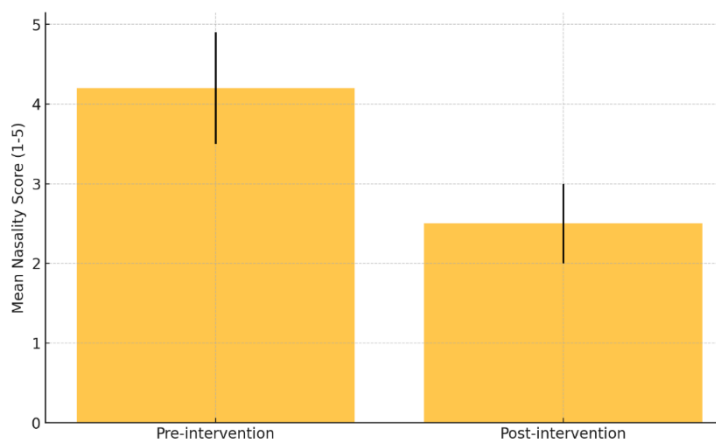
Quantitative Results

Improvements in Speech Intelligibility

The comparison of pre-and post-intervention speech intelligibility scores showed a notable increase in clarity and fluency of speech across the majority of participants. The mean pre-intervention score for speech intelligibility was 45% (SD = 8.3%), while the mean post-intervention score rose to 78% (SD = 6.2%). A paired t-test confirmed that this improvement was statistically significant ($p < 0.01$), suggesting that the interventions had a strong positive effect on the participants' ability to produce more connected and clear speech (Figure 1).

Figure 1.***Comparison of Pre- and Post-Intervention Speech Intelligibility******Reduction in Nasality***

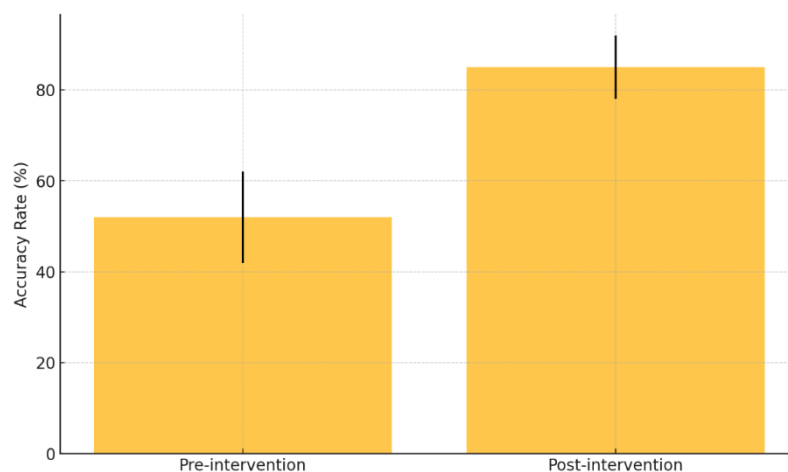
Another important result was the reduction in hypernasality observed in the participants' speech. The mean nasality score, measured on a scale of 1 to 5 (with 1 being normal resonance and 5 being severe hypernasality), decreased from a mean pre-intervention score of 4.2 (SD = 0.7) to a post-intervention score of 2.5 (SD = 0.5). This reduction in nasality was statistically significant ($p < 0.01$), indicating that the breathing and resonance exercises contributed to better control of airflow and voice modulation (Grunwell, 2017).

Figure 2.***Reduction in Hypernasality (Pre- and Post-intervention)******Articulation Improvement***

Articulation tests revealed improvements in the accurate production of consonant sounds, particularly plosives and fricatives, which are often affected by rhinolalia. The pre-intervention accuracy rate for producing target sounds was 52% (SD = 10%), and this increased to 85% (SD = 7%) after the 12-week therapy period. These results demonstrate a significant improvement ($p < 0.01$) in the participants' ability to produce consonants correctly, directly contributing to their overall speech intelligibility (Kummer, 2014).

Figure 3.

Improvement in Consonant Sound Production (Pre- and Post-intervention).



Qualitative Results

Parent Feedback and Psychosocial Impact

The thematic analysis of parental interviews highlighted several key themes, including increased confidence in communication, improved social interactions, and reduced frustration in the children's day-to-day communication. Parents reported that their children were more willing to engage in conversations, both at home and in social settings, as their speech improved. One parent mentioned, "My child is no longer shy about speaking in front of others, and they seem much more comfortable expressing themselves."

Parents also emphasized the value of the multi-sensory approach used during therapy. Many found that the tactile and visual cues helped their children understand and practice speech sounds more effectively. This feedback aligns with Shprintzen's (2018) findings on the importance of integrating various sensory modalities in speech therapy for children with craniofacial anomalies.

Satisfaction with the Therapy

Overall, parents expressed high levels of satisfaction with the therapy process, noting that the structured exercises and regular feedback from therapists helped them support their children's progress at home. The online platform used to track practice sessions was also highlighted as a helpful tool in monitoring and reinforcing therapy outside the clinical setting.

The study's results provide strong evidence that preoperative speech therapy, particularly focusing on articulation, breathing, and resonance exercises, significantly improves the speech outcomes of children with open organic rhinolalia. The quantitative data support a statistically significant improvement in speech intelligibility, nasality reduction, and articulation, while qualitative feedback from parents underscores the positive psychosocial impacts of the intervention.

DISCUSSION

The findings of this study align with the broader literature on preoperative speech therapy interventions for children with open organic rhinolalia. The significant improvements observed in both quantitative and qualitative aspects of speech underscore the efficacy of targeted therapeutic interventions in addressing hypernasality and articulation issues.

Speech Intelligibility and Hypernasality Reduction: The notable improvement in speech intelligibility, rising from 45% pre-intervention to 78% post-intervention, echoes the findings of Kummer (2014), Grunwell (2017), and Lohmander et al. (2020). The structured and consistent use of breathing and resonance exercises likely facilitated better airflow control, enabling participants to modulate their voice more effectively. This, in turn, reduced the nasality of their speech, a critical factor for clear and intelligible speech production. The mean reduction in nasality from 4.2 to 2.5 was both statistically and clinically significant. These results validate the effectiveness of the chosen techniques in minimizing hypernasal speech, a common challenge in rhinolalia treatment.

Improvement in Articulation: The increase in accurate consonant production, particularly with plosives and fricatives, reflects similar outcomes in studies by Grunwell (2017) and Shprintzen (2018). This improvement directly contributed to the overall speech intelligibility of participants. The therapy's emphasis on articulation drills and consonant practice helped the children better manage the nasal airflow and reduce the nasal emissions typically associated with consonant production in rhinolalia cases. These results suggest that the participants gained significant control over their speech mechanisms, translating into clearer, more connected speech.

Parental Feedback and Psychosocial Impact: The qualitative analysis further emphasizes the psychosocial benefits of speech therapy. The improvement in communication confidence, social interactions, and reduced frustration, as reported by parents, is consistent with Shprintzen's (2018)

findings that early intervention can positively impact a child's emotional and social development. The multi-sensory approach, which incorporated auditory and visual cues, was a key factor in the children's progress, supporting their ability to understand and practice speech sounds. Parents' satisfaction with the therapy process and the integration of home-based practice further highlight the importance of a collaborative approach between therapists and caregivers in speech interventions.

CONCLUSION

By using a mixed-methods approach, this study will provide a comprehensive evaluation of the techniques used in preoperative speech therapy for children with open organic rhinolalia. The combination of quantitative speech assessments and qualitative feedback from parents will allow for a holistic understanding of the effectiveness of these interventions in improving connected speech.

In conclusion, this study adds to the growing body of evidence that preoperative speech therapy plays a crucial role in improving speech outcomes for children with open organic rhinolalia. By focusing on hypernasality reduction and articulation improvement, alongside the integration of multi-sensory therapeutic approaches, the intervention not only enhances speech intelligibility but also positively impacts the children's psychosocial well-being. These findings advocate for the inclusion of structured, individualized speech therapy as a standard practice in preoperative care for children with rhinolalia, ensuring that they have the best possible speech outcomes both before and after surgical interventions.

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