

Critical Review:
In children with phonological/articulation disorders, do non-speech oral motor exercises improve speech production compared to direct speech therapy?

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This critical review examines the evidence evaluating the efficacy of non-speech oral motor exercises (NSOMEs) as a treatment approach for children with phonological/articulation disorders. Research studies include one randomized clinical trial design, one single group pre-test post-test design and one single subject design. Overall, the evidence does not support the use of NSOMEs to treat children with phonological/articulation disorders. Future and clinical recommendations are discussed.

Introduction

Children with speech sound disorders, such as phonological/articulation disorders, reportedly dominate the caseload receiving speech and language services (Lass & Pannbacker, 2008). Speech-Language Pathologists (SLPs) often use a variety of phonetic or phonemic-based approaches to treat children with phonological/articulation disorders. Another treatment approach that is commonly used by SLPs is the use of non-speech oral motor exercises (NSOMEs) (Lof & Watson, 2008). Lof and Watson (2008) documented that approximately 85% of SLPs, who are certified members of the American Speech and Hearing Association (ASHA), use NSOMEs as a primary treatment activity or in conjunction with other speech sound treatment approaches.

NSOMEs can be defined as a set of therapeutic activities that do not require speech production (Ruscello, 2008). NSOMEs can be further categorized into active muscle exercises, passive muscle exercises and sensory stimulation. Active muscle exercises, such as stretching, are used to build muscle strength. Passive muscle exercises, such as passive range of motion, are used to maintain joint flexibility, modify tone and improve vascular circulation. Additionally, sensory stimulation, such as massage or vibration, is used to enhance muscle function (Ruscello, 2008). Therefore, the focus of implementing NSOMEs in speech therapy is to improve the overall structure and function of the speech mechanism (Ruscello, 2008).

Currently, there is a lack of theoretical and empirical evidence supporting the efficacy of NSOMEs in therapy. However, there are SLPs who continue to use this approach despite limited research in the field. For this reason, a long-standing debate exists among researchers about whether it is appropriate to use a treatment approach without sufficient and favourable evidence available.

The use of NSOMEs is based on a number of assumptions that are not strongly supported in the literature. The first assumption is that the muscles used for speech are used the same way for non-speech activities (Bowen, 2005). Conversely, there is research indicating that there are differences in the organization of the nervous system for non-speech and speech movements. As a result, non-speech movements may not convert into speech movements (Bowen, 2005). The second assumption is that if non-speech activities are taught with relevance to speech, the underlying movements can be integrated for speech. Forrest (2002) argued against this claim stating that there is evidence suggesting that speech should be taught as whole units rather than discrete parts. Since NSOMEs are taught discretely, they are not likely to integrate into speech behaviours. Lastly, it is assumed that NSOMEs strengthen the articulators needed for speech. However, according to Forrest (2002), typically developing children use approximately 10-20% of maximal lip force abilities and 11-15% of maximal jaw force abilities when producing speech. This suggests that minimal strength is essentially needed for speech sound production (Forrest, 2002).

In addition to a weak theoretical foundation, the limited evidence base does little to resolve the dispute among researchers. To date, there have been few high quality studies published that have evaluated the effectiveness of NSOMEs to treat children with phonological/articulation disorders. However, the existing findings indicate that the use of NSOMEs in therapy is not empirically supported. SLPs are advised to be cognisant of the available research findings when selecting treatment methods for their clients. The use of evidence-based practice may assist clinicians in providing effective services to clients.

Objectives

The primary objective of this review is to critically evaluate the current literature examining the efficacy of NSOMEs as a treatment approach for children with phonological/articulation disorders. A secondary objective is to provide future and clinical recommendations.

Method

Search Strategy

Databases searched were CINAHL and PubMed. They were searched using the following terms: ((oral motor exercises) AND (articulation disorders or phonological disorders)), ((nonspeech oral motor exercises) AND (articulation disorders or phonological disorders)). The search was limited to articles in English. There was no limitation on the date of articles.

Selection Criteria

Three articles were selected to illustrate the direct implementation of NSOMEs to treat children with phonological/articulation disorders.

Data Collection

The literature search yielded one randomized clinical trial design, one single group pre-test post-test design and one single subject design.

Results

Randomized Clinical Trial Study

Early research suggests that the use of NSOMEs does not improve speech production compared to direct speech therapy. Christensen and Hanson (1981) used a between groups design to determine if oral myofunctional therapy facilitated an improvement in speech production in children with articulation disorders and tongue thrust behaviours. Participants included six boys and four girls between the ages of 5;8 and 6;9. All participants were from white middle class families with parents who were willing to participate directly in the study. Each participant had a severe anterior tongue thrust, a frontal lisp, normal hearing, normal developmental milestones, no physiological or psychological issues and no involvement in previous speech therapy. Children were assigned to groups receiving either articulation therapy only or a combination of articulation therapy and oral myofunctional therapy, which included the use of neuromuscular facilitation techniques. All participants received a total of 22 individual half-hour sessions. They attended sessions once a week

for six weeks, then twice a week for eight weeks for a period of 14 weeks.

Two independent observers evaluated pre-test and post-test scores on a test battery to determine if therapy facilitated any gains in speech production. The test battery included a word repetition test to evaluate tongue tip placement in the production of /n/, /d/, /l/, /m/, /s/, and /z/, a picture articulation test, the Goldman-Fristoe Test of Articulation (GFTA) (Goldman & Fristoe, 1969) and a tongue thrust evaluation.

Nonparametric tests were used to interpret results. The Sign Test was used to determine if improvements in speech production were due to chance or to intervention. The performance of both groups improved significantly with the exception of the scores on the tongue thrust evaluation for the group receiving articulation therapy only. The Fisher Exact Test was used to determine if the differences between the two groups were significant. Results revealed that the differences between the groups were only significant for the tongue thrust evaluation (0.05 level of confidence) and not for the word repetition test, picture articulation test or the GFTA (Goldman & Fristoe, 1969). Inter-rater reliability was 97.4% for presence or absence of tongue thrust, 87.8% for dentalization of /t/, /d/, /n/, and /l/, and 90.2% on correctness of /s/ and /z/ productions. The results of the study indicated that both groups exhibited equal improvements in speech production. Oral myofunctional therapy did not improve speech production, but it was effective in improving tongue thrust behaviours.

Based on research design and methodology, level IIa evidence was obtained from the study. Participants were specified and a description of treatment procedures was provided. The authors used a comparison group, appropriate blinding and valid statistical measures to evaluate the results of the study. However, a small sample size was included and the authors did not discuss selection bias or randomization procedures. Thus, the evidence for the use of NSOMEs as a treatment approach is equivocal.

Single Group Pre-test Post-test Study

More recent research complements earlier reports suggesting that the use of NSOMEs in therapy does not improve speech production. Guisti Braislin and Cascella (2005) examined the efficacy of an oral motor approach, *Easy Does it for Articulation: An Oral Motor Approach* (Strode & Chamberlain, 1997), without direct articulation therapy for children with mild articulation disorders. Participants included two

boys and two girls in grade one between the ages of 6;4 and 6;8. All participants were white and English speaking. They all passed a hearing screening, had normal academic and cognitive abilities, received a diagnosis of a mild articulation disorder of unknown origin, and had adequate oral and speech motor production as rated on the Kaufman Speech Praxis Test for Children (KSPT) (Kaufman, 1995) and the Oral Speech Mechanism Screening Examination (OSMSE) (St. Louis & Ruscello, 2000). Children were assigned to two groups of two. They received a total of 15 individual half-hour sessions. They attended sessions twice a week for a period of 7 weeks.

The GFTA-2 (Goldman & Fristoe, 2000) was administered at pre-test and post-test to examine if there were any improvements in speech production. Descriptive measures were used to interpret the results. The raw scores for the group at pre-test ranged from 4 to 13 errors (mean = 9, standard deviation = 4.70) and the raw scores at post-test ranged from 2-10 errors (mean = 6.5, standard deviation = 3.41). Overall, participants made 2.5 fewer errors at post-test. Based on the standard deviations, the number of errors did not significantly change for participants. Inter-rater reliability ranged from 84% to 97%. The results of the study indicated that all participants did not exhibit significant improvements in speech production after receiving oral motor therapy.

Considering research design and methodology, level III evidence was obtained from the study. Participants were specified and a description of treatment was provided. Outcomes were evaluated with appropriate blinding. However, the study had several weaknesses including small sample size, short study duration and the lack of a control group. Though the authors used valid descriptive measures, they did not include a statistical analysis and thus the findings cannot be judged as statistically significant. The evidence from the study can be considered equivocal for the use of NSOMEs in therapy.

Single Subject Study

The following study also provides evidence that the use of NSOMEs is not effective for improving speech production. Forrest & Iuzzini (2008) examined if oral motor training improved speech development in children with phonological/articulatory disorders (PADs) compared to production training (PT). Participants included nine children between the ages of 3;3 and 6;3. They all spoke English, had normal oral structures and passed a pure tone hearing screening. In addition, participants were administered

an informal test of volitional movements (VOM), the GFTA-2 (Goldman & Fristoe, 2000), the Peabody Picture Vocabulary Test-3 (PPVT-3) (Dunn & Dunn, 1997), the Clinical Evaluation of Language Fundamentals-Preschool (CELF-P) (Wiig, Secord & Semel, 1992) and a non-word repetition test. A language sample and speech recordings were also collected. Participants were included in the study if they scored below 85 on the GFTA-2 (Goldman & Fristoe, 2000) and had speech difficulties with 3 unrelated speech sounds on a 200-word probe test. All children received both types of training alternatively on two unrelated target speech sounds. One sound was treated using a traditional phonetic approach and one sound was treated with NSOMEs. Another unrelated target sound was selected as a control. Each participant received both treatments during a 60-minute session twice a week. Each type of treatment included imitation and spontaneous production phases. During sessions, participants moved to spontaneous productions when they scored 15/20 for imitated productions across 3 consecutive sets. The program was completed once participants correctly produced 20 out of 30 target sounds on a sound-specific generalization probe. However, if participants completed 20 sessions before achieving this score, the program was considered completed.

Statistical measures were used to interpret results. Using participants' scores from sound-specific generalization probes, the difference in percentage of correct production of a target sound from pre-treatment to post-treatment was calculated. One of the participants did not complete the post-treatment sound probe due to a scheduling conflict. Consequently, all participants' scores were based on the second last sound probe rather than the post-treatment sound probe. The mean average change of PT was a 30% increase from pre-treatment while the mean average change of NSOMEs was a 3% increase. A paired t-test was calculated and the results were statistically significant for PT. Eight of the nine participants showed more improvement producing the sound treated with PT compared to the sound treated with NSOMEs.

A qualitative evaluation of PT and NSOMEs was completed. The authors found that if NSOMEs preceded PT in a treatment session, it did not result in improved speech production compared to if PT preceded the use of NSOMEs. They also found that children with the lowest VOM scores did not show any significant gains when compared to children with the highest VOM scores. Therefore, NSOMEs did not improve oral motor function. The overall findings

suggested that oral motor training did not improve speech development in children who have PADs.

Based on research design and methodology, level I evidence was provided. This is considered to be the highest quality of experimental evidence available. Participants were specified and a description of treatment procedures was included. The authors used valid statistical measures and they adequately controlled for order effects by randomizing the order of specific treatments received. However, the study had a few weaknesses, which reduces the overall strength of the evidence. The authors used a small sample size and they did not provide any information about blinding assessors or reliability of outcome measures. Also, results may have been slightly skewed due to a participant dropping out of the study in the second last session. Though the authors provide recent and strong evidence against using NSOMEs in therapy, the evidence can be considered equivocal until additional well-designed studies are conducted to replicate similar findings.

Discussion

The purpose of this review was to determine if the use of NSOMEs is an effective and appropriate treatment approach for children with phonological/articulation disorders. Overall, the studies used valid measures, but they had a number of methodological flaws, such as small sample size (Christensen & Hanson, 1981; Guisti Braislin & Cascella, 2005; Forrest & Iuzzini, 2008), and insufficient information about randomization procedures (Christensen & Hanson, 1981), blinding procedures and reliability of outcome measures (Forrest & Iuzzini, 2008). Therefore, based on the reviewed studies, evidence is either weak or lacking in support of using NSOMEs in therapy to improve speech sound production.

When reviewing the results of the studies, the reader should be mindful of certain limitations that may have unintentionally affected the findings. One limitation involves the minimal progress made by participants. Christensen and Hanson (1981) noted that some participants in their study did not show any progress compared to other participants regardless of which type of treatment they received. This may be related to the fact that some participants presented with co-existing language problems, which possibly influenced the findings of the study. Additionally, Guisti Braislin and Cascella (2005) reported that all participants did not make any progress during their study. Though the authors concluded that NSOMEs are ineffective for improving speech production, a lack of progress may have been associated with

methodological weaknesses, such as study duration (7.5 treatment hours) and a small sample size.

A second limitation is that participants may have been beyond the age in which their sound acquisition patterns could be influenced. According to Forrest (2002), early sound correction is largely dependent on oral motor development and shaping rather than later sound correction. Participants in the reviewed studies ranged from ages 3;3 to 6;9, with the majority of children being in the older end of the range (Christensen & Hanson, 1981; Guisti Braislin & Cascella, 2005; Forrest & Iuzzini, 2008). Therefore, the age of participants may have been another factor that affected the overall findings.

A final concern is that some researchers do not provide detailed descriptions of the types of NSOMEs used in therapy (Christensen & Hanson, 1981; Forrest & Iuzzini, 2008). It is unclear which exercises were used in some studies (e.g., active muscle exercises, passive muscle exercises and/or sensory stimulation) and whether any of them were observed to be more or less effective than others. If this information was provided, it may help to support or refute assumptions that NSOMEs can convert into speech activities or can be integrated for speech (Bowen, 2005).

Conclusion

The best available research concludes that the use of NSOMEs is not an effective treatment approach alone or in combination with direct speech therapy for children with phonological/articulation disorders. Overall, the existing evidence can be considered equivocal. Further research is needed to provide more compelling evidence for or against the use of NSOMEs in a clinical setting.

Future Recommendations

Based on the weaknesses of the studies discussed in this review, the following recommendations are made to improve the strength of evidence in future studies:

1. Well-designed and randomized studies should be employed that offer stronger levels of evidence and larger sample sizes should be incorporated so findings can be generalized to encompass all children with phonological/articulation disorders.
2. Individual characteristics, such as age and co-existing language problems, should be considered to determine if certain factors influence the outcome of studies.

3. A detailed description of treatment should be provided to determine if there are effective types of NSOMEs.

Clinical Implications

SLPs should carefully evaluate the available research on NSOMEs and incorporate scientific evidence into their daily practice. If clinicians choose to use NSOMEs in therapy, clients or parents of clients should be made aware that this approach is, at most, considered experimental. However, it is strongly suggested that SLPs use evidence-based speech sound treatments to ensure positive gains in their clients' communication abilities.

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