Critical Review:
Effectiveness of oral motor interventions (OMIs) for improving feeding/swallowing outcomes in infants/children with swallowing problems

Kathrine Martin
M.Cl.Sc SLP Candidate
University of Western Ontario: School of Communication Sciences and Disorders

This critical review examined the current evidence available on the effectiveness of oral motor interventions (OMIs) for improving feeding/swallowing outcomes in infants/children with swallowing problems. A literature search of computerized databases identified three articles meeting the selection criteria (two systematic reviews, one meta-analysis). The articles were critically appraised using a critical appraisal outline. Overall, the available evidence was found to be inconclusive in terms of the effectiveness of using OMIs with infants/children with swallowing problems.

Introduction

Early and effective treatment of feeding and swallowing problems is important for nutritional outcomes as well as further oral motor development. Infants and children with feeding and swallowing problems are at a higher risk of experiencing health-related complications (Arvedson, 2000). In addition, the presentation, etiology, and severity of these swallowing problems vary greatly across this population (Arvedson, 2000), which leaves clinicians with the difficult task of determining the most appropriate approach to intervention when presented with these infants/children.

A large amount of the previous research on swallowing problems has been done in the area of adult dysphagia rather than the area of paediatric feeding and swallowing (ASHA, 2001). Evidence-based research for the treatment of paediatric feeding and swallowing is more difficult to find and evidence-based approaches to intervention from adult studies may not necessarily be directly translatable to the paediatric population (ASHA, 2001). In fact, developmental differences across the lifespan warrant consideration of these relationships in multiple age groups.

Oral motor skills necessary for feeding represent a progression/development of movement patterns, which require a high level of practice. Infants and children with swallowing problems often experience disruptions in the ability to practice oral motor movements. This can result in reduced development of these essential oral motor skills, impacting further advancement in development of the learned behaviours that also go along with these oral motor skills (Illingworth & Lister, 1964).

Since these infants/children may have pre-existing issues with oral motor control and then also miss many opportunities to learn and practice these skills, targeting oral motor functions appears to make intuitive sense for improving feeding and swallowing outcomes. Oral motor interventions (OMIs) are currently being used in clinical practice, however clinicians require evidence to support their practice. OMIs have been shown to be effective for improving oral function in children with neuromotor disorders (Manno, Fox, Eicher, & Kerwin, 2005) and could potentially help to improve feeding outcomes for other infants/children to help set them up for future development and more positive outcomes.

Some of the most common OMIs used in clinical practice with infants include, non-nutritive sucking (NNS) usually through the use of a pacifier, and oral/perioral stimulation (stroking or touching of various structures inside or outside of the mouth). The OMIs typically used with children include active exercises, passive exercises, and sensory application. It is also important to note that OMIs are used synonymously with the term oral motor exercises (OMEs) in the literature. Clinicians require the most up to date information on the effectiveness of approaches currently being used to help improve feeding and swallowing outcomes. For the purposes of the present review, both OMIs and OMEs will be considered synonymous and relevant to the question.

Objectives

The primary objective of this paper was to critically review existing literature regarding the effectiveness of OMIs for improving feeding and swallowing outcomes in infants/children with swallowing problems.

Methods

Search Strategy

Several electronic databases including PubMed, CINAHL, Cochrane, OVID, SCOPUS, and Google Scholar were searched. The following search terms were used: (oral motor interventions) OR (oral motor exercises) AND (swallowing disorders).
The search was performed in January 2016.

Selection Criteria
The search criteria yielded results for populations across the lifespan (infants to adults). Articles selected for inclusion in this critical review were required to include some type of oral motor intervention or exercise intervention and a focus on infants or children (individuals under the age of 18) with swallowing problems.

Data Collection
Based on the results of the literature search, three articles met criteria for inclusion in this critical review: a systematic review with a focus on preterm infants (Arvedson, Clark, Lazarus, Schooling, & Frymark, 2010a), a systematic review with a focus on children (Arvedson, Clark, Lazarus, Schooling, & Frymark, 2010b) and a meta-analysis focusing on preterm infants (Tian et al., 2015).

Results

Arvedson et al. (2010a) conducted a systematic review in order to determine an estimate of the effects of OMI on oral feeding and swallowing outcomes (both functional and physiological) and pulmonary health in preterm infants. Twelve studies were included in the review (experimental, quasi-experimental, or multiple-baseline single-subject design), focusing on three specific OMIs (nonnutritive sucking, oral/perioral stimulation, and a combination of NNS and oral/perioral stimulation). Six of these studies addressed the effects of OMI on feeding and swallowing physiology. Ten studies addressed the effects of OMI on functional oral feeding and swallowing outcomes. Results indicated that NNS had a generally positive effect on measures of swallowing physiology and reducing the number of days to transition to oral feeding, however, results of the review overall indicated mixed conclusions, with some studies indicating positive outcomes and others not showing positive outcomes for the effectiveness of OMI on improving feeding and swallowing. Heterogeneous participants and variations in the interventions limited the ability to compare across the studies included.

OMI was clearly defined by the authors and descriptions of outcomes were adequately described to replicate. Using a specific search strategy and well-specified inclusion and exclusion criteria, with sufficient detail to be replicated, the authors included articles from a single systematic search. The studies included were relevant to answering the research questions. Each study included in the systematic review underwent a thorough quality appraisal process and were rated using assessors blinded to other ratings, and adequate inter-rater reliability was reported. Appropriate effect sizes and confidence intervals were calculated for the outcome measures and analyzed for the included studies whenever possible. Articles were grouped appropriately, with each clinical question considered independently. Additional analyses were performed to determine the mean effect size of OMI for similar outcomes. Appropriate statistics were calculated to determine the degree of heterogeneity prior to combining the studies. However, due to excessive heterogeneity, the authors were not able to determine an average effect for either of the relevant clinical questions. This limits the ability to confidently determine the effect of the intervention.

This well-designed systematic review has many strengths, however, it summarized studies with some design limitations. Overall, this review provides some limited evidence in favour of the use of NNS to improve physiological outcomes (e.g., number of sucks per minute) but no clear evidence regarding the effect of oral/perioral stimulation on functional (e.g., weight gain) or physiological feeding and swallowing outcomes in preterm infants.

Arvedson et al. (2010b) presented findings from a systematic review investigating the quality of the evidence on the effects of OMEs on swallowing physiology, pulmonary health, functional swallowing outcomes, and drooling management in children with swallowing disorders. Pulmonary health is not a focus of the current study and will not be addressed further. Sixteen studies were included in the systematic review. Eight studies addressed the effects of OME on swallowing physiology, six studies examined functional swallowing outcomes, and five studies investigated the effects of OME on drooling. Overall, the authors reported limited support for the use of some specific OME treatments. There were mixed results for OME resulting in positive change on swallowing skills or drooling outcomes. Other outcome measures resulted in no change, maintenance on some outcome measures, and no maintenance on others. The authors highlighted that OMEs have many variations in how they are applied and vary across populations, degree of deficit, etiology, and risk factors, which could account for the mixed results in the systematic review.

The authors' definition of OMEs was clearly provided, with examples and explanations for the treatments typically used. Inclusion and exclusion criteria were adequately described, however the additional use of

hand search of references could impact the ability of someone to successfully replicate the search. All of the studies included were appraised for methodological quality using blinding across 2 raters, and adequate inter-rater reliability. Appropriate statistics were used, including effect sizes and corresponding confidence intervals (when possible). Several of the confidence intervals were not reported due to insufficient data from the included studies. Failure to report all statistics in the included studies limited the analyses possible in the systematic review, therefore limiting the credibility and the confidence clinicians can have in the reviewed results.

The systematic review provides suggestive evidence that given the current studies available, many with design limitations, OMEs provide little if any improvements towards feeding and swallowing outcomes.

Tian et al. (2015) performed a meta-analysis with the aim of objectively evaluating the potential of using OMI for improving the status of oral feeding in preterm infants. Eleven studies were included in the meta-analysis and the following outcome measures were analyzed: ten of the studies looked at transition time to oral feeding, six of the studies looked at length of stay in hospital, three of the studies looked at feeding efficiency, three of the studies looked at intake of milk, and three of the studies looked at weight gain. Overall, despite limitations in the quality of the studies included, the authors reported that the studies showed positive outcomes and had potential for clinical use for all of the outcome measures except weight gain.

In this meta-analysis, examples of typical OMI treatments used were provided. Inclusion and exclusion criteria were adequately described and there would likely be enough detail to replicate the procedure. Articles with randomized control trials written in both English and Chinese were included. Two independent investigators conducted the search and extracted the data. Inter-rater reliability was not provided. Each study included in the meta-analysis was assessed for methodological quality by two other independent investigators. Appropriate statistical analyses were performed and effect sizes with confidence intervals were reported. The authors also calculated appropriate statistics to determine the degree of heterogeneity present.

This meta-analysis presents evidence in favour of the clinical use of OMI, although many of the studies included had design limitations.

Discussion

The purpose of this critical review was to determine the effectiveness of OMI for improving feeding and swallowing outcomes in infants/children with swallowing problems. A review of the current literature yielded three studies that met criteria for inclusion in this critical review. The articles included in this review lack consistent findings for the use of OMI/OME with this population. Methodological weaknesses of the studies included in the systematic reviews and the meta-analysis (e.g., lack of assessor blinding, no intention to treat standard) limit the confidence clinicians can have in the results of the effects of OMI for infants and children.

Two of the included studies investigated the effects of OMI in preterm infants (Arvedson et al., 2010a & Tian et al., 2015). The most recent article (Tian et al., 2015) presented more favourable outcomes for the use of OMI with preterm infants than the systematic review by Arvedson et al., (2010a). Approximately half of the studies included in the Tian et al., (2015) meta-analysis were from China and there was minimal overlap of studies with Arvedson et al., (2010a). The studies included in the meta-analysis by Tian et al., (2015) were exclusively randomized controlled trials, whereas Arvedson et al., (2010a) included studies with experimental, quasi-experimental, or multiple baseline single-subject design. These design differences between the two studies could potentially account for some of the discrepancies between the outcomes of their analyses. However, both reviews stated that more studies with fewer methodological limitations are required. It is also possible that there is an inherent difference between the interventions provided in China compared to other countries (e.g., United States of America). Therefore, it is difficult to reconcile the contradictory findings across the two reviews, which warrants caution in interpreting the findings. Clinicians should err on the side of more conservative interpretation until more evidence is available.

Only one study included in this review addressed the use of OMI with children and is therefore the only evidence reviewed to determine the effectiveness of this type of treatment with this population (Arvedson et al., 2010b). Based on the information regarding how the treatments were carried out presented in the systematic reviews and the meta-analysis, the approaches used for OMI treatment varies greatly for children compared to infants (e.g., active exercises, passive exercises, and sensory application for children, versus NNS, and/or oral stimulation for infants). For the purpose of the present review, infants and children were grouped together because there were so few studies available for review. In the future, infants and children should be

reviewed separately and not grouped together into one population.

Although the use of OMI/OME with infants/children with swallowing problems makes intuitive sense to many clinicians, at this time the evidence is not favourable. Some studies show positive outcomes with this type of treatment, whereas others do not. In addition, there is a lot of variability in many of the treatment approaches, which makes it difficult to determine how to best implement this type of intervention.

Conclusion

There is no definitive evidence that OMI is an effective approach to improving feeding or swallowing outcomes in infants/children. Heterogeneous participants and varied interventions limit the applicability of these results.

Clinical Implications

Swallowing and feeding concerns in infants/children can impact development and cause a lot of stress for the patient/client and their families. Developing effective treatment approaches to help these infants/children has proven to be a difficult task. Based on the results of the current critical review, the onus is on clinicians to carefully and thoroughly evaluate the effectiveness and assess the appropriateness of this type of treatment in cases where clinical judgment appears to warrant the use of OMIs/OMEs, prior to implementing them with infants/children with swallowing problems.

References

American Speech-Language-Hearing Association. (2001). *Roles of speech-language pathologists in swallowing and feeding disorders: technical report* [Technical Report]. Available from www.asha.org/polic

Arvedson, J. C. (2000). Evaluation of children with feeding and swallowing problems. *Language, Speech, and Hearing Services in Schools*, *31*(1), 28-41.

Arvedson, J., Clark, H., Lazarus, C., Schooling, T., & Frymark, T. (2010a). Evidence-based systematic review: effects of oral motor interventions on feeding and swallowing in preterm infants. *American Journal of speech-language pathology*, *19*(4), 321-340.

Arvedson, J., Clark, H., Lazarus, C., Schooling, T., & Frymark, T. (2010b). The effects of oral-motor exercises on swallowing in children: an evidence-based systematic review. *Developmental Medicine & Child Neurology*, *52*(11), 1000-1013.

Illingworth, R. S. & Lister, J. (1964). The critical or sensitive period, with special reference to certain feeding problems in infants and children. *Journal of Pediatrics*, 65, 839-848.

Manno, C. J., Fox, C., Eicher, P. S., & Kerwin, M. L. E. (2005). Early oral-motor interventions for pediatric feeding problems: what, when and how. *Journal of Early and Intensive Behavioral Intervention, 3*, 145–159

Tian, X., Yi, L. J., Zhang, L., Zhou, J. G., Ma, L., Ou, Y. X., & Song, G. M. (2015). Oral motor intervention improved the oral feeding in preterm infants: Evidence based on a meta-analysis with trial sequential analysis. *Medicine*, *94*(31).