Five Reasons Why Nonspeech Oral Motor Exercises (NSOME) Do Not Work

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Abstract

Nonspeech oral motor exercises (NSOME) are used often by speech-language pathologists to help children improve their speech sound productions. However, the phonology, articulation, and motor speech development and disorders literature does not support their use. This article presents five reasons (four theoretical, one empirical) why NSOME are not an appropriate therapeutic technique for treating children's speech sound production problems.

Evaluation of the efficacy of nonspeech oral motor exercises (NSOME) for remediating children's speech sound production errors has occurred for almost a decade (Forrest, 2002; Lof, 2003). During this time, several studies have been conducted and review articles written, all of which have documented weak theoretical underpinnings for using nonspeech techniques. Despite this body of work, approximately 70-85% of clinicians continue to use these exercises (Cima, Mahanna-Boden, Brown, & Cranfill, 2009; Hodge, 2009; Hodge, Salonka, & Kollias, 2005; Lof & Watson, 2008). Their use is controversial and persists as a dilemma within the field of speech-language pathology: should speech-language pathologists (SLPs) continue to use procedures that are advocated by other clinicians, have attractively packaged products for purchase, and have some intuitive qualities, or should they heed the theoretical and empirical evidence that documents their ineffectiveness (Lof, 2008; McCauley, Strand, Lof, Schooling, & Frymark, 2009; Mullen, 2005; Powell, 2008a, b)?

NSOME are defined as any techniques that do not require the child to produce a speech sound, but are used to influence the development of speaking abilities (Lof & Watson, 2008). A new term recently has been introduced, Oral Placement Therapy (OPT), by Bahr and Rosenfeld-Johnson (2010), but many of the articulatory movement techniques for OPT can still be classified as NSOME. For example, during nonspeech OPT, the client may practice the movement of lip closure around a spoon, blow horns, or place a tongue depressor horizontally across the lips in order to encourage the lip posture for /b/ (Hill, 2009).

NSOME have been reported to be used for children with disparate problems associated with dysarthria, childhood apraxia of speech, structural anomalies, velopharyngeal inadequacy, Down syndrome, late talker diagnosis, phonological impairment, hearing impairment, and functional misatrticulations (Lof & Watson, 2008). The most frequently used exercises included blowing (with and without horns), pucker-smile movements, tongue

pushups/wags/curling, tongue-to-nose-to-chin movements, and cheek puffing (Lof & Watson). Clinicians who use NSOME reported that they believed the exercises improved tongue elevation and lateral movements, increased awareness of the articulators, increased tongue and lip strength, improved jaw stabilization, and increased lip/tongue protrusion (Lof & Watson).

This article summarizes five reasons why NSOME should not be used as a therapeutic technique to improve children's speech sound productions. Four of the reasons are based on theoretical justifications and the final rationale pertains to the available research evidence. An extensive list of references provides additional resources for SLPs who seek more in-depth information on each topic.

Transference of Part to Whole

One reason NSOME should not be used is that training a part of the speech gesture will not transfer to the whole gesture. There are two problems with NSOME associated with this, the lack of integration of the speech movements and their irrelevancy to the speaking task. Typically, NSOME fracture the articulatory gesture into individual movements, with isolated practice on a small portion of the speech motion. An example of this recently was reported to us by a student clinician who was assigned to a practicum with an SLP employed in a public school. The student described how a child had been extensively drilled to use an exaggerated "lower lip biting" maneuver with the ultimate goal of evoking the /f/ sound. Over the course of many sessions, only the isolated lingual-dental gesture was practiced but never the actual sound.

Research has shown that tasks that comprise highly organized or integrated movements, like speech, will not be enhanced by practicing the fractionated constituent parts of the movements alone (Forrest, 2002; Kleim & Jones, 2008). Instead, learning is best when the entire gesture is trained and not separated into meaningless parts (Ingram & Ingram, 2001; Velleman & Vihman, 2002; Wightman & Lintern, 1985). Training the small components of well-organized behaviors can actually diminish learning (Forrest). If the therapeutic goal is the production of a complex speech movement, then practice on just a portion of that movement will not be effective.

Most NSOME disintegrate the highly integrated task of speaking into component movements that are irrelevant for the production of speech (Hodge & Wellman, 1999; Lof, 2003, 2009; Weismer, 2006). Isolated movements of the articulators are not the actual gestures used for the production of speech sounds, so their ability to improve speech is not possible. For example, no speech sounds require tongue-tip elevation toward the nose, puffed-out cheeks, blowing, or tongue-wagging (Lof, 2009). Only practice with the speech gestures (i.e., speaking) will improve speech.

An example outside of speech intervention illustrates the need to integrate movements in order for learning to occur (Weismer, 1996). Shooting a basketball is a highly integrated motor movement; a coach would never ask a basketball player who is trying to improve her hoop skills to practice just the arm motion, then just the knee bend, then just the shoulder movement, then just the wrist action, etc., all in isolation of the other motions. Instead, the player would be encouraged to practice integration of all of these motions into one fluid motion. Like shooting a basketball that requires an assimilation of a multitude of muscle movements, speaking also requires an integration of movements. Working on isolated parts will not improve the whole gesture. Here is another basketball analogy used to illustrate the need for involving relevant tasks. A player is only successful in skill development when practicing shooting with an actual ball in hand. Practicing shooting without a ball is ludicrous and an ineffective teaching strategy. Likewise, practicing the irrelevant, isolated movements associated with speaking without actually producing speech is equally ineffective.

It is cautioned that NSOME should not be confused with phonetic placement cuing. This type of cuing usually involves some kind of verbal direction for articulator placement followed by speech production (Scripture & Jackson, 1925). For example, to elicit the production of /s/, a child may be instructed to "put your tongue on the magic spot on the ridge behind your teeth" as an appropriate placement cue. Once placement is achieved, then the sound is evoked. A NSOME that would not be helpful would be repeated practicing of an isolated tongue-tip-to-alveolar ridge movement in the hopes that it will eventually lead to a /s/ production. Isolated training of only a part of a complex movement will not help with the production of the speech sound.

Strength Training

Strength needs often are cited as a primary reason for conducting NSOME (Hodge, 2009; Lof & Watson, 2008). However, typically strength is not an issue for speaking. There are four issues concerning speech and articulator strength. First, the articulators do not need to be very strong in order to produce speech, as it has been shown that the articulators use only 11-30% of the maximal amount of strength they are capable of producing (Bunton & Weismer, 1994; Wenke, Goozee, Murdock, & LaPoint, 2006). Further, articulator weakness does not always correlate with reduced speech intelligibility. This was demonstrated in a research study that focused on individuals with amyotrophic lateral sclerosis (ALS). Results showed that speech intelligibility was not related to the subjects' oral-facial muscle weakness (DePaul & Brooks, 1993). Duffy (2005) concluded that articulator strength training using nonspeech activities usually is not appropriate or effective for individuals with motor speech disorders. The act of speaking does not require strong articulators; rather what is needed are agile articulators that can produce fine-grained and coordinated movements. It is well known that such skillful movements will not be developed through strength training (i.e., skill training vs. strength training) (Jensen, Marstrand, & Nielsen, 2005; Kleim et al., 2002; Remple, Brauneau, VandenBerg, Goetzen, & Kleim, 2001).

The second issue with strength is that most NSOME do not follow the basic strength training paradigm. To strengthen muscles, exercises must be done with multiple repetitions, against resistance, until failure (Clark, O'Brien, Calleja, & Corrie, 2009; Clark, 2008; Clark, 2003; Robbins et al., 2005). If the well-documented strength training regimen is not followed then there will be no gains in strength. The evidence on strengthening the articulators (with most coming from the swallowing literature) has shown that a prodigious effort is needed to increase oral strength (Clark et al., Robbins et al.) and this strength increase only effects swallowing. Other studies have shown that strength training can increase strength but does not improve function (Sjögreena, Tuliniusb, Kiliaridisc, & Lohmanderd, 2010) and the strength gains are not usually maintained over time (Clark et al.; Sjögreena et al.). Imagine how many tongue wags (which must be done against resistance) would need to be accomplished in order to actually increase tongue strength. Most NSOME do not strengthen the articulators because of the lack of adherence to the strength training procedures.

A third issue is the difficulty of measuring and documenting oral strength. Typically, SLPs use subjective observations (e.g., feeling the force of the tongue pushing against a tongue depressor; simply observing the ballistic movements of the articulators) to "document" the strength of the articulators (Shipley & McAfee, 2009). It has been reported repeatedly that such statements pertaining to articulator strength are highly unreliable (Clark, Henson, Barber, Stierwalt, & Sherrill, 2003; Solomon & Munson, 2004). Because most clinicians cannot initially objectively verify that strength is actually diminished, they also cannot report an increase in strength following NSOME using these subjective measurements. Without objective measurements (e.g., using the Iowa Oral Pressure Instrument or a Tongue Force Transducer), testimonials of articulator strength gains after using NSOME must be considered suspect.

Finally, diminished strength causing speech problems in children with speech sound disorders has been questioned (as it has with dysarthric speakers, see above). Children with speech difficulties typically do not have reduced oral strength (Dworkin & Culatta, 1980; Sudbery, Wilson, Broaddus, & Potter, 2006); SLPs must be cautious not to confuse muscle tone with muscle strength. Interestingly, some studies report that children with speech problems may actually have stronger articulators (Sudbery et al.). Using NSOME for children with speech sound disorders to increase their articulator strength is not an efficient use of therapy time.

Organization of the Brain

Another reason not to use NSOME is that the organization of the brain is task-specific. Even though the same structures are used for speaking and nonspeech oral tasks (e.g., the tongue for speaking as well as licking an ice cream cone), those structures are mediated by different parts of the brain, depending on the purpose of the task (Weismer, 1996, 2006). This is referred to as "task specificity." Although identical oral structures are used, these structures function differently for speech and nonspeech activities, precluding the uses of nonspeech tasks to improve speech (Bonilha, Moser, Rorden, Bylis, Fridriksson, 2006; Bunton, 2008; Kleim et al., 2002; Ludlow et al., 2008; Moore, Caulfield, & Green, 2001; Moore, Smith, & Ringel, 1988; Moore & Ruark, 1996; Schultz, Dingwall, & Ludlow, 1999; Wilson, Green, Yunusova, & Moore, 2008; Ziegler, 2003). Speech is special and unlike other motor tasks (Kent, 2000, 2004; Terumitsu, Fujii, Suzuki, Kwee, & Nakada, 2006).

Bonilha and colleagues (2006) clearly demonstrated speech versus nonspeech task specificity. Using fMRI scanning, 18 normal adults produced the nonspeech movements of biting the lower lip, tongue elevation, tongue protrusion, lips pressed together, and other motions. Another set of tasks consisted of speech movements during production of common syllables. Results showed that the nonspeech movements activated different parts of the brain compared to brain activation for speech movements. In other words, tasks that were similar to speech but were not speech were represented in different parts of the neuroanatomy. The organization of the brain is for specific tasks, not for specific muscles or articulators (Salmelin & Sams, 2002). Because the brain is designed to program movements for specific tasks, using nonspeech therapy activities will not aid in the production of speech.

Similarly, the development of early oral motor behavior (e.g., sucking, chewing) are not precursors to speech because of task specificity. It is well documented that these early behaviors do not lay a foundation for speech (Moore & Ruark, 1996; Nip, Green, & Max, 2009), so practicing early developing nonspeech movements will not influence speech movements. Working on the skills for feeding, sucking, chewing or other nonspeech mouth tasks do not transfer to the skill of speech because of task specificity.

Effect on the Mouth

NSOME do not warm or wake up the mouth or provide metamouth awareness. Warm-up of muscles is only necessary for tasks that approach the muscle maximum because they tax the muscular system. For example, a runner needs to warm up prior to jogging (muscle maximum) but not before going for a leisurely walk, a weight-lifter needs to warm-up prior to lifting weights (muscle maximum) but not before lifting a coffee mug. Therefore, muscle warm up is not necessary for tasks that are below the maximum. As previously stated (see Strength Training above), speech does not come close to this muscle maximum level (Clark, 2008; Moore & Ruark, 1996; Wenke et al., 2006) so warm up is not a useful activity in therapy.

Many SLPs report that they use NSOME to provide children with an awareness of articulator movements and placements (Hodge, 2009; Lof & Watson, 2008). However, research has shown that young children have difficulty indentifying and associating movements for

speech with actual speech productions. Research by Klein, Lederer, and Cortese (1991) shows a lack of any significant relationship between children's ability to define or describe the characteristics of speech production with actual articulation performance. In other words, young children probably do not understand the nonspeech mouth cues provided by NSOME that can be transferred to speaking tasks. The exercises do not actually provide any mouth awareness because children are unable to use their "metamouth" skills (Klein et al.; Koegel, Koegel, & Ingham, 1986). Once older children have "meta" skills, then explicit cueing is more beneficial than an indirect approach using NSOME. NSOME do not "wake up the mouth" or explicitly demonstrate phonetic placement; teaching children to be aware of their articulators does not appear to be appropriate or necessary.

Lack of Evidence

A systematic review of published articles pertaining to NSOME was conducted by an American Speech-Language-Hearing Association (ASHA) subcommittee (McCauley et al., 2009). The results of that review showed there was insufficient published evidence at that time to make a definitive statement about the efficacy of NSOME. That is, there is not enough published evidence from treatment studies to support or not support the use of NSOME as a viable treatment technique for children's speech sound disorders. On the other hand, evidence from studies that were not published (i.e., peer reviewed presentations at conventions thus not part of the systematic article review, or articles published after the systematic review [e.g., Forrest & Iuzzini, 2008]) overwhelmingly demonstrated that NSOME do not bring about changes in speech sound productions (for a review of these articles see: Lass & Pannbacker, 2008; Lof, 2003; Ruscello, 2008a, b). None of these studies showed any effectiveness of NSOME either alone or in conjunction with traditional therapy approaches. Even though most of the research that has evaluated the lack of effectiveness of NSOME therapy have primarily used single-subject research designs instead of large-scale group designs, the results should discourage clinicians from using such techniques.

This information begs some questions. Should an intervention technique be used only if it is supported by efficacy data? Should an intervention technique be used until research shows it lacks efficacy? Evidence-based practice (EBP) dictates that evidence and well-studied theories cannot be ignored. This means that clinicians should not rely on therapeutic folklore (Kamhi, 2008; Lof, in press), and they must use caution when considering using untested products and methods. There are many well-established and empirically tested therapy alternatives to using NSOME for the multitude of classified childhood speech disorders, including velopharyngeal inadequacy (Ruscello, 2008b), children in early intervention settings (Davis & Velleman, 2008), treatment for childhood apraxia of speech (McCauley & Strand, 2008), and other types of phonological/articulation problems (Baker & McLeod, in press a, b; Tyler, 2008; Watson & Lof, 2008). Those therapies are based on strong theoretical principles and are supported by scientific and/or clinical evidence.

Conclusions

SLPs often are faced with the dilemma of choosing to use an intervention approach that does not have the highest levels of research support (Law, Garrett, & Nye, 2004). In those instances, other types of evidence should be used to help justify clinical decisions. In the case of NSOME, clearly basic evidence on speech physiology (see the first three reasons cited above) precludes their use. In addition, using therapy time to increase awareness may not be as beneficial to children as actually targeting and establishing the production of speech sounds. It is acknowledged that basic research does not always correspond with clinical research; however, what is known about speech physiology, motor learning, and typical speech-language development counter indicates the use of NSOME as viable options for remediating children's speech sound disorders.

It is interesting to speculate about why clinicians use NSOME despite the lack of clinical evidence (see Lof, 2009 for potential reasons). One reason offered by Kamhi (2008) is the history of oral motor treatment techniques in our profession, which may have resulted in confusion between "speech-facilitating oral motor techniques and non-speech oral motor techniques" (p. 333). Kamhi (2004) also suggested that nonefficacious clinical techniques perpetuate because of their ease of understanding and implementation, factors which often override the use of more scientifically based techniques. That is, even though the literature that supports the use of NSOME is without accurate scientific and clinical support, the subjective claims of success and simple instructions on how to implement the techniques may overshadow the lack of scientific merit and efficacy. Currently the available scientific evidence and the theoretical underpinnings do not make the use of NSOME to remediate children's speech sound difficulties a viable choice.

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