

Logic, Theory and Evidence Against the Use of Non-Speech Oral Motor Exercises to Change Speech Sound Productions

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Introduction

Non-Speech Oral Motor Exercises (NS-OME) Defined

- *Any technique that does not require the child to produce a speech sound but is used to influence the development of speaking abilities (Lof & Watson, 2004; In press).*
- *A collection of nonspeech methods and procedures that claim to influence tongue, lip, and jaw resting postures, increase strength, improve muscle tone, facilitate range of motion, and develop muscle control (Ruscello, In Press).*

Do SLPs use NS-OME? Nationwide survey of 537 SLPs by Lof & Watson (2004; In press)

- 85% use NS-OME to change speech sound productions.
- Hodge, Salonka, & Kollias (2005): Nationwide survey of 535 SLPs in Canada found that 85% use NS-OME to change speech sound productions, the same result as in the USA!
- Clinicians report being “*Very Familiar*” with the research that has examined the efficacy of NS-OME and the theoretical basis for using them.
- 61% of the clinicians agree with this statement: “*The literature I have read strongly encourages the use of NS-OME.*”
- 87% of the clinicians learned to use NS-OME from non peer-reviewed CEU offerings, workshops, and in-services.
- **Most frequently used exercises** (in rank order): Blowing; Tongue Push-Ups; Pucker-Smile; Tongue Wags; Big Smile; Tongue-to-Nose-to-Chin; Cheek Puffing; Blowing Kisses; Tongue Curling.
- **Reported benefits** (in rank order): Tongue Elevation; Awareness of Articulators; Tongue Strength; Lip Strength; Lateral Tongue Movements; Jaw Stabilization; Lip/Tongue Protrusion; Drooling Control; VP Competence; Sucking Ability.
- **These exercises are used for children with** (in rank order): Dysarthria; Apraxia of Speech (CAS); Structural Anomalies; Down Syndrome; Enrollment in Early Intervention; “Late Talker” Diagnosis; Phonological Impairment; Hearing Impairment; Functional Mis-articulations.

Evidence-Based Practice

- **Defined:** The conscientious, explicit, and unbiased use of current best research results in making decisions about the care of individual clients (Sackett et al., 1996). Treatment decisions should be administered in practice only when there is a justified (evidence-based) expectation of benefit.
- **No Child Left Behind** places an emphasis on scientifically-based methods, calling on clinicians to use scientific, research-based interventions.
- **2006 IDEA Part B Regulations:** *“Special education and related services...must now be based on peer-reviewed research to the extent practicable.”*
- **The goal** is to use the literature in a savvy process that draws on a number of different factors in which evidence plays a key role.
- **Dollaghan (2004)** reminds clinicians that when using the EBP paradigm, valid and reliable evidence needs to be given more credence than intuition, anecdote and expert authority. Evidence must come from works that are independent and peer-reviewed.
- **Opinions** and clinician's own clinical experiences can be useful, but they can also be biased and even wrong!
- **Therapist Bias:** Halo effect and Rosenthal effect (see Damico, 1988).

Logic

- **Clinical experience cautions:** Finn, Bothe, and Bramlett (2005) provided criteria for distinguishing science from pseudoscience: (1) Treatments remain unchanged even with evidence against its effectiveness because disconfirming evidence is ignored; (2) Anecdotal evidence and personal experience are given extraordinary credence; (3) Inadequate evidence is accepted; (4) Peer review is avoided; (5) Methodology is disconnected from established scientific models; (6) Use of new terms that are not scientific nor conventional; (7) Grandiose outcomes are proclaimed; (8) Claims of success only within a holistic framework.
- **Many claims are made about NS-OME effectiveness** in catalogs selling therapy materials, non-peer reviewed publications, CEU events, etc. But no evidence of effectiveness is provided.
- **Some claims of effectiveness are outrageous** and are actually illogical when carefully examined.

Theory

Part-Whole Training and Transfer

- **Basic questions:** Does training on a smaller portion of the articulatory gesture transfer over to the whole gesture? Is it more efficient with better learning by first training just part of the movement and not the whole movement?
- Tasks that comprise highly organized or integrated movements (such as speaking) will not be enhanced by learning the constituent parts of the movement alone; training on just the parts of these well-organized behaviors can actually diminish learning. Highly organized tasks require learning the information processing demands, as well as learning time-sharing and other inter-component skills.
- *“Fractionating a behavior that is composed of interrelated parts is not likely to provide relevant information for the appropriate development of neural substrates”* (Forrest, 2002).

- Some clinician-researchers believe that it can be more effective to “Train the Whole” (Ingram & Ingram, 2001) and to use “Whole-Word Phonology and Templates” (Velleman & Vihman, 2002) rather than breaking up the gesture into small parts.

Strengthening the Articulatory Structures

- **Basic questions:** Is strength necessary for speaking? If so, how much? Are the articulators actually strengthened by using NS-OME? How do SLPs objectively document weakness of articulators and also objectively document supposed increases in strength after NS-OME?
- **Articulatory strength needs are VERY low** for speech and the speaking strength needs do not come anywhere close to maximum strength abilities of the articulators. For example, lip muscle force for speaking is only about 10-20% of the maximal capabilities for lip force, and the jaw uses only about 11-15% of the available amount of force that can be produced (see also Bunton & Weismer, 1994).
- **Agility** and fine articulatory movements, rather than strong articulators, are required for the ballistic movements of speaking. NS-OME encourage gross and exaggerated ranges of motion, not small, coordinated movements that are required for talking.
- **NS-OME may not actually increase articulator strength.** To strengthen muscle, the exercise must be done with multiple repetitions, against resistance, until failure...and then done again and again. Most NS-OME do not follow this basic strength training paradigm so there are probably no actual strength gains occurring due to these exercises.
- **Articulators can be strengthened** (e.g., the tongue for oral phase of swallowing or the VP complex) but these strengthened articulators will not help with the production of speech.
- **Measurements of strength are usually highly subjective** (e.g., feeling the force of the tongue pushing against a tongue depressor or against the cheek or just “observing” weakness), so clinicians cannot initially verify that strength is actually diminished and then they cannot report increased strength following NS-OME. Only objective measures (e.g., tongue force transducers) can corroborate statements of strength needs and improvement. Without such objective measurements, testimonials of articulator strength gains must be considered suspect.
- **See Chi-Fishman and Pfaizer (2003)** for information on tongue anatomy, physiology, and strengthening principles.

Relevancy of NS-OME to Speech

- **Relevancy is the only way to get changes in the neural system;** the context in which a skill is learned is crucial. In order to obtain transfer from one skill to another, the learned skills must be relevant to the other skills. “...*muscle fibers are selectively recruited to perform specific tasks, so static non-speech tasks do not account for the precise and coordinated activity needed during speech*” (Hodge & Wellman, 1999).
- For sensory motor stimulation to improve articulation, the stimulation must be done with relevant behaviors, with a defined end goal, using integration of skills. “*The PURPOSE of a motor behavior has a profound influence on the manner in which the relevant neural topography is marshaled and controlled*” (Weismer, 2006).
- **Most NS-OME dis-integrate the highly integrated task of speaking** (e.g., practicing tongue elevation to the alveolar ridge with the desire that this isolated task will improve production of the lingual-alveolar sound /s/). For example, a motor task (e.g., shooting a free throw using a basketball) must be learned in the context of the actual performance goal. By analogy, no one would teach a ballplayer to *pretend* to hold a ball and then *pretend* to

throw it toward a non-existent hoop with the eventual hope of improving free throwing ability. Breaking down basketball shooting or the speaking task into smaller, unrelated chunks that are irrelevant to the actual performance is not effective.

- Another non-speaking example would be the illogical finger pounding on a tabletop to simulate playing on a piano. Learning and improving piano playing must be practiced on a piano, not on a tabletop. Likewise, learning and improving speaking ability must be practiced in the context of speaking. To improve speaking, children must practice speaking, rather than using tasks that only superficially appear to be like speaking.
- Because isolated movements of the tongue, lips and other articulators are not the actual gestures used for the production of any sounds in English, their value for improving production of speech sounds is doubtful. That is, no speech sound requires the tongue tip to be elevated toward the nose; no sound is produced by puffing out the cheeks; no sound is produced in the same way as blowing is produced. Oral movements that are irrelevant to speech movements will not be effective as speech therapy techniques.

Task Specificity

- **Three related concepts:** ①same structures but different functions, ②task specificity, ③domain specific.
- **The same structures used for speaking and other “mouth tasks”** (e.g., feeding, swallowing, sucking, breathing, etc.) function in different ways depending on the task and each task is mediated by different parts of the brain. The organization of movements within the nervous system is not the same for speech and nonspeech gestures. Although identical structures are used, these structures function differently for speech and for nonspeech activities.
- **Weismer (2006):** The control of motor behavior is task (speaking) specific, not effector (muscle or organ) specific. There is strong evidence against the “shared control” for speech and nonspeech. *“Motor control processes are tied to the unique goals, sources of information (e.g., feedback), and characteristics of varying motor acts, even when those share the same effectors and some neural tissue.”*
- **Some examples of task specificity:** Babbling and early nonspeech oral behaviors are not related (e.g., Moore & Ruark, 1996); Patients can have dysphagia with and without speech problems (i.e., “double dissociations”; Ziegler, 2003); It is well documented that the VP mechanism can be strengthened, however, reduction of speech nasality does not occur (e.g., Kuehn & Moon, 1994); Breathing for speech is different than breathing at rest or during other activities (e.g., Moore, Caulfield, & Green, 2001). See Weismer (2006) for summary of 11 studies that show that speech and nonspeech are different for a wide variety of structures, including facial muscles, jaw motion, jaw operating space, jaw coordination, lingual movement, lip motions, levator veli palatini, and mandibular control.

Warm-Up/Awareness/Metamouth

- **Warm-up has a physiological purpose** during muscle exercise: to increase blood circulation so muscle viscosity drops, thus allowing for smoother and more elastic muscle contractions (Safran, Seaber, & Garrett, 1989).
- **Warm-up of muscles** may be appropriate (Pollock et al., 1998) when a person is about to initiate an exercise regimen that will maximally tax the system (e.g., distance running or weight training). However, muscle warm-up is not required for tasks that are below the maximum (e.g., walking or lifting a spoon-to-mouth). Because speaking does not require anywhere near the oral muscular maximum, warm-up is not necessary.

- If clinicians are not using the term warm-up to identify a physiological task to “wake up the mouth,” then perhaps they believe that they are providing some form of “metamouth” knowledge about the articulators’ movement and placement.
- **Awareness and its role in therapy** is always questioned. It is well known that young children have difficulty with various metaphonological awareness tasks (Kamhi & Catts, 2005). For articulation awareness, Klein, Lederer and Cortese (1991) reported that children age 5 and 6 years had very little consciousness of how speech sounds were made; 7 year olds were not very proficient with this either. According to Koegel, Keogel, and Ingham (1986), some children older than 7 years were successful during a metalinguistic speech intervention program, but only when they have the “...*cognitive maturity required to understand the concept of a sound...*”
- **It appears that young children cannot take advantage of the non-speech mouth-cues** provided during NS-OME that can be transferred to speaking tasks. More research is needed to determine the minimum cognitive, linguistic, and motor abilities of children that are necessary for such “meta” skills.

Childhood Apraxia of Speech (CAS)

- **Children with CAS have adequate oral structure movements for nonspeech activities** but not for volitional speech (Caruso & Strand, 1999), so this would preclude the use of NS-OME because non-speech is not the problem.
- **There is no muscle weakness for children with CAS**, so there is no need to do strengthening exercises. If there is weakness, then the correct diagnosis is dysarthria, not apraxia.
- “*Non-speech therapy activities will not improve a child’s (with CAS) speech. Activities that address speech directly are critical for that purpose*” (Velleman, 2003).
- See the quote by Davis & Velleman (2000) below.

NS-OME for Non-Motor Speech Disorders

- Some may believe that motor exercises can help children with motor production speech problems, such as functional misarticulators (phonetic/articulatory problems) or children with structural problems; however the evidence does not support this.
- It makes no sense that motor exercises could help improve the speech of children who have non-motor problems such as language/phonemic/phonological problems like children in Early Intervention diagnosed as late talkers.

Cleft Lip/Palate

- The VP mechanism can be strengthened through exercise (many studies have demonstrated this since the 1960s), but added strength will not improve speech productions.
- See the quotes by Peterson-Falzone, Trost-Cardamone, Karnell, Hardin-Jones (2006) below.

Evidence

There are 10 studies evaluating the effectiveness of NS-OME: 9 show no benefits, 1 shows benefits (but it has many methodological flaws).

1. **Christensen & Hanson (1981).** Ten children aged 5;8 to 6;9 years underwent 14 weeks of treatment, with half of the children receiving only articulation therapy and the other half

- receiving articulation and neuromuscular facilitation techniques. Both groups made equal speech improvements; the exercises did not help for better speech sound production BUT they were effective in remediating tongue-thrusting (probably due to task specificity).
2. **Gommerman & Hodge (1995)**. Single Subject Design (A-B-C) with a 16-year-old girl with tongue thrust and sibilant distortions. Therapy was baseline (A phase), myofunctional therapy (B phase), then articulation therapy (C phase). Tongue thrust was eliminated with myofunctional therapy but speech did not change until speech therapy was initiated.
 3. **Colone & Forrest (2000)**. Monozygotic twin boys age 8;11 years old took part in a motor treatment for Twin 1 and phonological treatment for Twin 2. No improvements with motor training occurred but there were improvements using a phonological approach; when Twin 1 received phonological treatment, there were the same improvements as for Twin 2.
 4. **Occhino & McCane (2001)**. Single Subject Design (A-B-C-B-C) with a 5-year-old child. Oral motor exercises alone produced no improvement in the articulation of one of two phonemes and also no improvements in oral motor skills. Oral motor exercises prior to or along with articulation therapy did not have an additive or facilitative effect but productions did improve with articulation therapy.
 5. **Abrahamsen & Flack (2002)**. Single Subject Design with a 4-year-old child for 10 hours of individual treatment using blowing, licking, and oral stimulation. There was no evidence of effectiveness in changing speech sound productions after this treatment.
 6. **Bush, Steger, Mann-Kahris, & Insalaco (2004)**. Single Subject Design (ABAB Withdrawal) with a 9-year-old boy. OME added to articulation treatment, then removed, then re-added for the sounds /r/,/s/,/z/,/l/. “Oral motor treatment did not improve or reduce treatment's *success*.”
 7. **Roehrig, Suiter, & Pierce (2004)**. AB or BA Single Subject Design with six 3;6 to 6;0 year old boys and girls for 15 weeks of therapy: (A) Tradition, production-based therapy twice a week for ½ hour; (B) Passive OME and traditional therapy twice a week for ½ hour. “*The addition of OME to the traditional articulation therapy approach did not add to participant's overall progress; improvement following therapy with OME was not different from improvements following articulation therapy alone.*”
 8. **Guisti & Cascella (2005)**. Single Subject Design using two boys and two girls in first grade. Therapy followed *Easy Does it for Articulation: An Oral Motor Approach* for 15 one-half hour individual treatment sessions. No evidence of effectiveness in changing speech-sound productions.
 9. **Hayes et al. (In submission)**. Six 4-year-olds, five boys and one girl who all had “functional misarticulations” were studied in a counterbalanced intervention design where children were randomly assigned to a specific order for an oral motor approach and traditional articulation approach. The traditional treatment resulted in significant speech sound changes but there was no support for oral motor therapy bringing about any changes. There was some evidence that NS-OME actually hindered learning.
 1. **Fields & Polmanteer (2002)**. Eight 3- to 6-year-old children were randomly assigned to one of two groups: four children received 10 minutes of oral motor treatment and 10 minutes of speech therapy and four children received 20 minutes of only speech therapy. Fewer errors at the end of 6-weeks of treatment for the children who received the combination of treatments. But there were many methodological and statistical issues that may invalidate this finding, such as: the children in the speech-only group were more severe; there was an unequal gender distribution; and there was no report of what the treated sounds were so there can be no evaluation as to how difficult it was to treat certain sounds.

Combining Treatment Approaches

- Most SLPs use a combination of treatment approaches so it is difficult to “tease apart” which approach is providing therapeutic benefit. Additionally, whenever intervention approaches are combined, it is unknown if and how they actually work in conjunction with each other to enhance performance.
- There is much evidence that the NS-OME portion of combined treatments is irrelevant to speech improvements (see above).
- NS-OME probably do not harm the child when used in combination with traditional approaches (however, Hayes et al. [2006] found that some children may be negatively affected by a combination approach).
- It seems reasonable that if there is no speech improvement using combined approaches, then clinicians should eliminate the approach that is not effective (i.e., the NS-OME) so as to not waste valuable therapy time with an ineffectual technique.

In Conclusion

- **If clinicians want speech to improve**, they must work on speech, and not on things that LOOK like they are working on speech.
- **Phonetic placement cues** that have been used in traditional speech therapy are NOT the same as NS-OME.
- **NS-OME is a procedure not a goal.** The goal of speech therapy is NOT to produce a tongue wag, to have strong articulators, to puff out the cheeks, etc. Rather, the goal is to produce intelligible speech.
- **We have been burned before.** In the 1990s many SLPs inappropriately embraced Facilitated Communication (FC) as a treatment approach because they thought they observed that it worked. Once it was tested using scientific methodology, it was found to not work. Pseudoscientific methodologies can persuade clinicians to provide the wrong treatment.
- **Speech is special** and unlike other motor movements.
- **Following the guidelines of Evidence-Based Practice**, evidence needs to guide treatment decisions. Parents need to be informed that NS-OME have not been shown to be effective and their use must be considered experimental.
- Just remember: **Same structures, different functions. Same structures, different functions.**

Relevant Quotes

- **Weismer, G. (2006).** “...oromotor nonverbal tasks are unlikely to contribute to an understanding of normal and disordered speech production.”
- **Gerratt et al. (1991).** “Preference for nonspeech maneuvers is surprising since so little research exists on the relations of these measures to speech...”
- **Davis & Velleman (2000):** “There is presently no research available to support the efficacy of oral-motor therapy for improvement of speech productions skills. Thus, it is appropriate to work with children with DAS (Developmental Apraxia of Speech) on nonspeech oral-motor skills themselves, but improvement in speech should not be expected as a result.”
- **Peterson-Falzone, Trost-Cardamone, Karnell, & Hardin-Jones (2006):**
 - “Do not invest time or advise a parent to invest time and money addressing a muscle strength problem that may not (and probably does not) exist. It is very frustrating to see clinicians working on “exercises” to strengthen the lips and tongue tip when bilabial and

- lingua-alveolar sounds are already evident in babble, or when bilabial and lingual/lingua-alveolar functions are completely intact for feeding and other nonspeech motor behaviors.”*
- *“Having a repaired cleft does not mean a child will lack the muscle strength needed to produce consonant sounds adequately. The presence of a cleft palate (repaired or unrepaired) has no bearing on tongue strength or function (why would it?). The majority of children who demonstrate VPI do so because their palate is too short to achieve VP closure. Muscle strength or lack thereof is not a primary causal factor associated with phonological delays in this population.”*
 - *“...blowing should never be used to “strengthen” labial or soft palate musculature; it does not work. Children who appear to improve over time in therapy when using these tools are likely demonstrating improvement related to maturation and to learning correct motor speech patterns. Had therapy focused only on speech sound development, these children probably would have shown progress much sooner.”*
 - **Love, R.J. (2000):**
 - *“...recently the profession has rejected the concept of a direct correlation between oral movements and speech and eating behavior.”*
 - *“...speech movement control was mediated at a different level in the nervous system than was nonspeech movement control.”*
 - *“...it is clear that the infantile reflexes involved in chewing and swallowing behavior are mediated at brain-stem levels, not at the cortical level of oral-motor control as is speech.”*
 - *“...improvement of infantile chewing and swallowing behavior in no way contributes to the development of neural networks for speech production.”*
 - *“...oral reflexes and chewing and swallowing behavior are relatively independent of speech production mechanisms.”*
 - *“...recent studies of the development of mandibular action in normal children suggests that motor coordination for speech activities is clearly different than it is for nonspeech activities...”*
 - *“...[there is] doubt that muscle weakness or pathological muscle imbalance of oral and mandibular muscles is critical for speech movements.”*
 - **Hodson, B.W. (1997):** *“...research data supporting efficacy of oral-motor exercises for unintelligible children as a whole are lacking.”*
 - **Tyler, A. (2005).** *“I strongly advise against the use of oral-motor exercises for children with phonological-articulatory disorders...”*
 - **National Joint Committee for the Communication Needs of Persons with Severe Disabilities (2006):** *“There are different types of oral-motor exercises. Typically, oral-motor treatment consists of three types of activities: active exercise, passive exercise, and external stimulation. Active exercise involves strength training and muscle stretching. Passive exercise involves clinician assistance and may involve massage, stroking, or tapping parts of the oral musculature. Clinicians also may use external stimulation, which includes hot and cold application, vibration, or electrical stimulation to the muscles involved in speech and swallowing. At this time, there is limited data-based evidence to support the use of oral-motor activities to help with speech production. Available evidence is based primarily on expert opinion; randomized clinical trials with a randomized control group, the highest level of evidence, have not been conducted. Data are available on the effectiveness of speech (articulatory and phonological) treatment. Thus, use of oral-motor treatment techniques may take time away from treatment approaches that are known to be effective, such as teaching the correct way to position the tongue to produce a correct speech sound. Some researchers*

suggest that speech and language treatment should be task specific. That means that treatment techniques should be related to the desired outcomes. If improved speech is the goal, it follows that treatment techniques should be speech-specific. Oral-motor treatment techniques are sometimes applied based on the assumption that oral motor problems contribute to speech problems. However, this may not be an accurate assumption, particularly when no muscle weakness is apparent in the oral mechanism.”

- **Smith (2006).** “Infants do not start life with language and motor mappings in place; many years of learning must occur. The speaker must develop a set of maps that include language, motor, and auditory networks.”

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