What Works for Speech Sound Disorders: Using Evidence to Guide Practice

Presented by

Gregory L. Lof, PhD, CCC-SLP
Chair/Professor      ASHA Fellow
Department of Communication Sciences and Disorders

Boston, MA  glof@mghihp.edu  www.mghihp.edu
INTRODUCTION

- Among the most prevalent communication disability in preschoolers and school age children; affects approximately 10% of this population.
- For 80% of these children, the disorder is sufficiently severe to require treatment.
- **Prevalence of speech delay in 6-year old children and co morbidity with language impairment** (Shriberg, Tomblin, & McSweeny, 1999)
  - Speech delay was approximately 1.5 times more prevalent in boys (4.5%) than girls (3.1%)
  - Cross-tabulations by sex, residential strata, and racial/cultural backgrounds yielded More than half of the children diagnosed with speech sound problems will have later academic difficulties in language, reading, and spelling.
- **Prevalence of speech delay in 4 to 5 -year old children from Australia** (McLeod & Harrison, 2009) 4,983 children in Australia, data obtained in 2 ways (Questionnaires from parents and from teachers)
  - 25.2% of parents indicated they had concerns about how their child “talks and makes speech sounds”; 22.3% of teachers reported similar levels of concern

School SLPs Work with Speech-Sound Disorders

<table>
<thead>
<tr>
<th></th>
<th>Percentage of Students (Grade level)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>K – 3</td>
</tr>
<tr>
<td>Speech-sound production</td>
<td>58.5</td>
</tr>
<tr>
<td>Intelligibility</td>
<td>19.8</td>
</tr>
<tr>
<td>Spoken Language Production</td>
<td>37.7</td>
</tr>
<tr>
<td>Spoken Language Comp.</td>
<td>28.2</td>
</tr>
<tr>
<td>Fluency</td>
<td>5.3</td>
</tr>
<tr>
<td>Pragmatics</td>
<td>3.0</td>
</tr>
<tr>
<td>Voice</td>
<td>&lt;1.0</td>
</tr>
</tbody>
</table>


Effects on Daily Life

- Long term consequences; Difficulty processing linguistic information; Fewer years of formal education; Hold jobs as unskilled laborers; Difficulties in reading/writing; May have children with speech sound problems
- Canadian 25 year follow up on children with and without speech-language impairments (Johnson, Beitchman, & Brownlie, 2010): Different results from prior data, probably because other studies combined speech/language problems. Co morbid language problems is a key predictor of language and academic problems in children with speech sound disorders.

Societal Attitudes

- Children with minor /w/ for /r/ substitution are considered to be: Less talkative; Dysfluent; Unpleasant to listen to; Soft; Boring; Nervous; More tense; Afraid; Isolated; Uncomfortable; Less confident; Dull (*Silverman & Paulus, 1989*)
- Social acceptance of an actor with a mild speech-sound impairment was less positive than the same actor demonstrating a physical disability. (*Anderson & Antonak, 1992*)
- People with speech impairment were found to be less extroverted and socialized with fewer people than people with typical speech productions. (*Felsenfel et al., 1992*)
- **Ontario Association For Families of Children With Communication Disorders**
  [http://www.oafccd.com/factshee/fact74.htm](http://www.oafccd.com/factshee/fact74.htm)
Examined 2nd grade teachers’ perception of the academic, social, and behavioral competence of students with moderate speech sound disorders. Compared to children with no speech sound disorders...

Will have social difficulty; Peers will make fun; Possible behavior problems; Shy because of speech; Seems young; Hard to understand; School extremely hard; Reading affected; Spelling delay; Writing a challenge; Felt sorry for child (Overby, Carrell, & Bernthal, 2007).

Terms: A History Lesson of Terms
- 1920-1970: Articulation
- 1970-1980: Articulation/Phonology
- 1980-2000: Phonology
- Current Term: Speech Sound Disorders

Genetic Bases of Speech Sound Disorders (Lewis, Shriberg et al., 2006)

A Model of “Input” and “Output” (See chart on Page 13)

DEVELOPMENTAL NORMS

Assumptions about Developmental Norms
- Universal order; Developmental prerequisites; Methodological issues in gathering norms
- See page 16 of Sander’s Norms

A “Sequence” of Development (Shriberg, 1993):
- Order of speech-sound acquisition divided into three categories

<table>
<thead>
<tr>
<th>Order</th>
<th>Continuous Speech</th>
<th>Articulation Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early 8</td>
<td>m b j n w d p h</td>
<td>m b n w d p h g</td>
</tr>
<tr>
<td>Middle 8</td>
<td>t η k g f v tʃ ɹ</td>
<td>t η k f v tʃ ɹ j</td>
</tr>
<tr>
<td>Late 8</td>
<td>s z l r</td>
<td>s z l r</td>
</tr>
</tbody>
</table>


Norms for Treatment Eligibility
- Problem 1: Which set of norms can you believe?
- Problem 2: Holding children with disorders to a HIGHER standard.

Norms for Target Selection
- Issue 1: Universal Order
  - Is there a universal order? Data from other languages. Children with disorders follow normal?"
- Issue 2: Developmental Prerequisites
  - Is mastery of earlier developing sounds necessary before production of later developing sounds?
- Issue 3: Early vs. Late

PHONOLOGICAL PROCESSES

Phonological Processes: Historical Origins (Stampe’s Natural Phonology Theory)
- Assumptions; Full Perception Hypothesis; Underlying representation assumption
  - Suppression instead of development; Explanation vs. Description

Reasons NOT to Use Phonological Processes
- Philosophical reasons
- Clinical reasons
- Terminology reasons (processes vs. processing)
  - The ability to use phonological codes to encode, store and retrieve information.
• Practice with a sound or syllable shape should not continue until 80%; some success should lead to attempts at greater sound combinations in longer strings of utterances, require more complex motor planning.

Look for the pattern

Do not write negative goals

Things to Look for to Help Identify Patterns
Finding Non-Obvious Patterns

o Phonetic Context; Word Position; Intra-class Variability; Syllable Structure; Morphological Ending; Syllable Stress; Syllable Boundary; Situational Context

SOME THOUGHTS ON ASSESSMENT

Procedures that should be accomplished...

• Articulation test (52% of SLPs use Goldman-Fristoe Test of Articulation)
• Continuous speech analysis (citing vs. talking; Morrison & Shriberg, 1992)
• Hearing screening
• Stimulability assessment
  o Stimulability as a Dynamic Assessment
  o Teaching Stimulability:
    ▪ Enhancing stimulability to increase the phonetic inventory (Miccio & Elbert, 1996; Miccio, 2005), using a multi-sensory approach: Concept, Movement, Icon
    ▪ Use with young children with a very limited phonetic inventory.
    ▪ Pair consonant sounds with alliterative characters and motions.
    ▪ Seven Components of Treatment to Enhance Stimulability
      1. Determine Stimulability
      2. Directly Target Nonstimulable Sounds
      3. Make Targets the Focus of Joint Attention (more likely to produce a sound when they are attending to and interested in its corresponding referent. Speech sounds may be easier to learn when they are associated with interesting objects that have been verbally labeled for them.)
      4. Associate Speech Sounds with Hand/Body Motions (multi-modal input increases children’s ability to retain newly learned speech sounds. Hand motions serve as retrieval cues for remembering).
      5. Associate Speech Sounds with Alliterative Characters of Interest to the Child. (interesting characters increase interest in the activity and encourage full participation. Enhances the opportunity for a child to develop conscious awareness of the newly learned sound segments. For example:

| p | Putt-putt pig |
| d | Dirty dog |
| f | Fussy fish |
| s | Silly snake |
| b | Baby bear |
| k | Coughing cow |
| v | Viney violet |
| z | Zippy zebra |
| t | Talkie turkey |
| g | Goofy goat |
| θ | Thinking thumb |
| ∫ | Shy sheepy |

http://speech-language-therapy.com/pdf/miccio4s.pdf

6. Encourage Vocal Practice (do not use drill; instead, encourage vocal practice by including sound elicitation activities that involve turn-taking and requesting).
7. Ensure Early Success (teach stimulable and nonstimulable sounds concurrently so they can have success but also receive remediation for nonstimulable sounds).
Summary of Stimulability

- Production of a sound during stimulability testing attests to the child’s ability to perceive, to recognize as different, and to produce the sound in question.
- If the child is not stimulable for a sound, then one might question the child’s: Motoric abilities, Perceptual abilities, Linguistic abilities, Attention (focus), Non-compliance.
- If a child is stimulable for a sound, then that sound is likely to be added to the child’s phonetic inventory, even without direct treatment on that sound.
- If a child is NOT stimulable for a sound, then the likelihood of short term gains is poor; normalization without therapy is much poorer than normalization for sounds that the child is stimulable for.
- Training on stimulable sounds is likely to improve regardless of what is taught.
- Sounds that are NOT stimulable are unlikely to change without direct treatment.
- In therapy, we need to encourage exploratory sound productions and provide phonetic placement or other types of cues to effect stimulability skills.
- Once stimulability has been achieved, generalization is more likely to occur.
- To avoid frustration in training nonstimulable sounds, use less directive sound play activities (e.g., those suggested by Miccio & Elbert, 1996) to provide a nurturing and supportive therapy environment.

Perception/discrimination assessment

- Is it still relevant? What assessment tools should be used?
- Locke (1980) Speech Production/Perception Test (SPPT)

Oral-peripheral screening


Case history—Some potential question to ask parents: Describe your child’s current speech performance; How often can your child’s speech be understood by parents, siblings, playmates, other relatives, strangers? How often does your child try to self-correct the speech errors? How willing is your child to repeat words after you, to try to say them correctly? How is your child’s speech in imitation compared to when s/he says the words by him/herself? How would you describe your child’s willingness to repeat his/her idea if it is not understood? How would you describe your child’s willingness to talk? What is your estimation of severity of your child’s speech problem? Did your child ever have ear infections or uninfected fluid in the ears? Would you consider your child’s physical development as typical? Please comment.

PCC: Percent of Consonants Correct

- An objective severity metric; The examiner makes correct/incorrect judgments of individuals sounds produced.

\[
PCC = \frac{\text{Number of Correct Consonants}}{\text{Number of Correct + Incorrect Consonants}} \times 100
\]

- Problems with PCC: Does not take age into account; Only evaluates consonants; Originally based only on conversational speech; Does not take into account type of errors.
  - Research shows the conversational speech and this imitative approach provide comparable results.
  - Efficient and valid approach for children 4 to 6 years old (but can be used for other children).
  - Uses sentence imitation.
  - Easily scored on the form and easy PCC calculation.
Intelligibility
- A guideline for expected intelligibility can be calculated by dividing the child’s age in years by four and converting that number into a percentage: 2-year-old: 50%; 3-year-old: 75%; 4-year-old: 100% (Hodson, 2011)

Intelligibility (see Ertmer, 2011) (see Handout Page 15)
- “Speech assessments that rely mainly on clinician impressions and word-based articulation tests appear to be inadequate for monitoring the development of intelligible connected speech.” “Recent research has shown that word-based articulation tests are not dependable estimates of connected speech intelligibility.”
- Words from the G-F Articulation Test had higher percentage of words identified than words in short sentences (86.7% vs. 54.5%).
- Articulation tests were poor predictors of connected speech intelligibility. “Children may correctly articulate a variety of consonants and vowels in single words but still not have readily intelligible connected speech.”

Intelligibility Assessment: Scaling Procedures
- Asking listeners to rate intelligibility along a continuum (10-point equal appearing interval scale or use descriptors: not at all, seldom, sometimes, most of the time, always).
  - Disadvantages: Listeners have different internal criteria (pretty good for one may be not very good to another); Numerical numbers do not have clear meaning; Scaling is insensitive to the middle range of intelligibility (ratings may not well distinguish between 30% and 60% intelligibility).
  - Modifications: Use clear descriptors instead of numbers: No words were understood; a few words were understood; approximately half of the words were understood; most of the words were understood; almost all of the words were understood.

Intelligibility Assessment: Item Identification Procedures
- Open set where listener writes down the words understood; Audio recordings of unfamiliar sentences, listeners write words understood, place an X for words not understood; Scored as a percentage of the number of times there was a match

Intelligibility Assessment: Item Identification Procedures for preschool and early elementary (4 lists, 10 sentences each)
- Presentation: Clinician says each sentence while using objects to act it out; Children watch and then imitate the sentence; Presented 2x for listener to write down all words; Percentage of words correctly written

Intelligibility Assessment: Item Identification Procedures for children who can read
- Presentation: Clinician shows the card and says the sentence; Card is turned over and child is asked to say the sentences; Presented 2x for listener to write down all words; Percentage of words correctly written

Intelligibility in Context Scale (McLeod, Harrison, & McCormack, 2012)
- An easy to administer, valid, and reliable estimate of preschool children’s intelligibility when speaking with people of varying levels of familiarity and authority.
  - Developed as a parent-rated measure of intelligibility when speaking with people of varying levels of familiarity and authority: Parents and 6 other types of communication partners (e.g., “Do you understand your child?” \(\Rightarrow\) “Do strangers understand your child?”)
  - The rating is on a 5-point Likert scale: 1 = Never; 2 = Rarely; 3 = Sometimes; 4 = Usually; 5 = Always
Procedures that are “always used” in assessment (Skahan, Watson, & Lof, 2007)

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case History</td>
<td>76%</td>
</tr>
<tr>
<td>Intelligibility</td>
<td>75%</td>
</tr>
<tr>
<td>Single Word Test</td>
<td>74%</td>
</tr>
<tr>
<td>Hearing Screening</td>
<td>71%</td>
</tr>
<tr>
<td>Stimulability</td>
<td>68%</td>
</tr>
<tr>
<td>Parent Interview</td>
<td>61%</td>
</tr>
<tr>
<td>Oral Motor-Non Speech</td>
<td>58%</td>
</tr>
<tr>
<td>Oral Motor-Speech</td>
<td>54%</td>
</tr>
<tr>
<td>Phonological Processes</td>
<td>51%</td>
</tr>
<tr>
<td>Connected Speech Sample</td>
<td>36%</td>
</tr>
<tr>
<td>Phonological Inventory</td>
<td>36%</td>
</tr>
<tr>
<td>Classroom Observation</td>
<td>31%</td>
</tr>
<tr>
<td>Perception/Discrimination</td>
<td>13%</td>
</tr>
<tr>
<td>Phonological Awareness</td>
<td>13%</td>
</tr>
<tr>
<td>Contextual Testing</td>
<td>11%</td>
</tr>
<tr>
<td>Syllable/Word Shapes</td>
<td>11%</td>
</tr>
</tbody>
</table>

Helpful Assessment Forms
- Place/Manner/Voicing forms (see Handout Page 17)
- Phonetic/Phonemic Inventory Forms
  - Phonetic Inventory: A listing of speech sounds that are produced regardless of the target (independent analysis) (See Eisenberg & Hitchcock, 2010)
  - Phonemic Inventory: A listing of the speech sounds produced in comparison to the target sound (relational analysis)
- Cluster Analysis Forms (See Handout Pages 18-19): Powell (1995); McLeod, van Doorn, & Reed (2001); Smit (1993); McLeod & Hand (1991)

Some questions to ask about potential targets (Tyler, 2005; 2008)
- How are word/syllable structures affected by error patterns?
  - Frequency of different syllable structures; Match between target & structure productions; Determine affected syllable structures
- Which sound classes are proportionally more affected by error patterns?
  - Fricatives? Stops? Liquids? Place/Manner/Voicing analysis is helpful
- Are there positional constraints?
  - Do the errors occur in all positions? Is it an inventory constraint or positional constraint?
- What sounds are present/absent in the phonetic inventory?
  - Use a phonetic inventory form; do you expand the inventory or do you make the inventory more useful?
- What is the stimulability status of the sounds in error?
  - Do you select stimulable or nonstimulable sounds?

10 Factors to Consider for Selecting Targets (based on Powell, 1991)

1. **Age of Child/Age Appropriateness of Error(s):** Use norms and other developmental information (Shriberg, 1993)

<table>
<thead>
<tr>
<th>Order</th>
<th>Continuous Speech</th>
<th>Articulation Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early 8</td>
<td>m b j n w d p h g</td>
<td>m b n w d p h g</td>
</tr>
<tr>
<td>Middle 8</td>
<td>t n k g f v t f d g</td>
<td>t n k f v t f d g j</td>
</tr>
<tr>
<td>Late 8</td>
<td>f θ s z l r 3</td>
<td>f θ s z l r</td>
</tr>
</tbody>
</table>

2. **Effect on Intelligibility--Error type:** Deletions → Substitutions → all others
3. **Effect on Intelligibility--Deviancy:** Unusual, deviant, idiosyncratic
4. **Frequency of Sound Occurrence** (Shriberg & Kent, 2013)
   - /n,t,s,r/ account for 25% of all phoneme occurrences.
   - /a,n,t,i,s,r,l,d,e/ account for nearly half of all phoneme occurrences.
   - /n,d,t,r,z/ comprise more than 69% of the final consonant occurrences in words.
Order of sound occurrence:

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. n</td>
<td>5. l</td>
<td>9. m</td>
<td>13. p</td>
<td>17. g</td>
</tr>
<tr>
<td>2. t</td>
<td>6. d</td>
<td>10. w</td>
<td>14. v</td>
<td>18. j</td>
</tr>
<tr>
<td>3. s</td>
<td>7. ð</td>
<td>11. z</td>
<td>15. f</td>
<td>19. ñ</td>
</tr>
<tr>
<td>4. r</td>
<td>8. k</td>
<td>12. b</td>
<td>16. h</td>
<td>20. θ</td>
</tr>
<tr>
<td>21. ʤ</td>
<td>22. ʃ</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(5) **Homonymy**: The production of one phonetic form for several adult target forms (e.g., [bat] for bad, bark, bent, bite; [bi] for beach, beat, beak, bike)

(6) **Markedness** (a part of complexity models): The aspects that have more features are considered marked and more complex. Working on the most marked aspects can be more effective in therapy (e.g., fricatives are more marked than stops; affricates are more marked than fricatives; clusters are more marked than singletons; voiced is more marked than voiceless).

(7) **Morphological Status**: Evaluate the tense markers and language structures that mark agreement. Those complex final clusters should then be targeted (especially if client has speech AND language problems):

<table>
<thead>
<tr>
<th>Morpheme</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present Progressive “ing”</td>
<td>barking</td>
</tr>
<tr>
<td>Regular Plural “-s”</td>
<td>dogs</td>
</tr>
<tr>
<td>Possessive “’s”</td>
<td>baby’s</td>
</tr>
<tr>
<td>Regular Past “-ed”</td>
<td>jumped</td>
</tr>
<tr>
<td>Regular Third Person “-s”</td>
<td>she eats</td>
</tr>
<tr>
<td>Contractable copula</td>
<td>He’s the baby</td>
</tr>
<tr>
<td>Contractable auxiliary</td>
<td>She’s going slow</td>
</tr>
</tbody>
</table>

(8) **Phonetic Inventory**: Determine completeness of the phonetic inventory, the repertoire of speech sounds produced independent of the adult model.

(9) **Relevance to Child**: Select sounds/patterns important to the client.

(10) **Stimulability**: Reasons to and not to select nonstimulable sounds.

---

**PHONOLOGICAL THERAPY APPROACHES**

Baker (2004); Baker & McLeod (2011); Williams, McLeod, & McCauley (2010)


**Minimal Pairs (a.k.a.: Minimal Opposition Contrast Therapy)**

- Use pairs of words that differ by one phoneme only; for example: bow/boat
- Used to establish contrasts not present in the phonological system
- Usually words are selected with one word as the target, the other the replacement
- Child should be stimulable for correct sound
- Have child say both words in the pair
- Show a communicative confusion if both words are said the same

**Maximal Pairs (a.k.a.: Maximal Oppositions Therapy)**

- Word pairs have multiple feature contrasts (maximal oppositions)
- Features can differ on place, manner, and voicing
- The oppositions contrasts only two sounds
• A sound the child correctly produces is compared to a maximally different one

• An example: *chop/mop*
  o Suppose a child produces /t/.
  o Maximal Pairs: /t/ is contrasted with maximally opposed sound from /ʃ/ (perhaps /m/); For example: me/she; Mack/shack, my/shy

• Follow the procedures for minimal pairs

• Who is best to use Maximal Pairs?
  o Best used for moderate/severe children
  o Meant to change the child’s entire phonological system because research shows it promotes generalization

**Multiple Oppositions**

• Much like minimal pairs, but pairs all or most errors simultaneously

• Good approach if child substitutes a single sound for multiple sounds

• Child confronts the rule from multiple contrasts

• For example: /t/ for /s, k, tj/; tr/

**Metaphonological**

• A subcategory of metalinguistics.

• Involves child’s conscious awareness of sounds within the language.

• Phonological awareness is the awareness of sound/phonological structure of spoken words in contrast to written words.

• Intervention to enhance early phoneme awareness and letter knowledge, combined with intervention to improve speech intelligibility, may ensure that children with speech impairment approach literacy instruction with age-appropriate phonological awareness development and will help with speech sound productions.

• This combined approach has shown to work for both speech sound training and for literacy development.

• Work on intelligibility, phoneme awareness, and letter-name/letter-sound knowledge.
  o Phoneme blending (adult says: b—a—I, child says “ball”).
  o Phoneme segmentation (adult says: “ball”, child says “b—a—I”).
  o Phoneme manipulation: Say “boat” without the “t”; What word would you make if you put “o” before “pen”?  

**Cycles/Cyclical Approaches**

• Cycles approach first developed by Hodson & Paden (1983).

• Typically a phoneme (or consonant cluster) is targeted one hour per week (i.e., one 60-minute session, two 30-minute sessions, or three 20-minute sessions), with each pattern typically being targeted from two to five hours per cycle

• Phonological patterns are divided into primary (those targeted first and then recycled as needed until they began emerging in conversational speech) and secondary patterns (see Hodson, 2011).

• Remediation Structure:
The child reviews production-practice picture cards from the previous session. These cards are then set aside (and may be used again along with new, more complex words during a later cycle, depending on whether the phonological pattern needs to be recycled). The SLP then reads a list of approximately 20 words that contain the new target pattern for the week. The child listens attentively, but must not repeat these words.

The child participates in experiential-play production-practice motivational activities (e.g., bowling, flashlight game), naming pictures and objects of four or five carefully selected target words with the week's pattern before taking a turn in the activity. The SLP changes activities every eight to 10 minutes. Many of these activities are repeated during ensuing weeks.

A metaphorology activity is incorporated (e.g., rhyming, segmentation) to enhance the child's phonological awareness skills.

The SLP probes for the optimal phoneme target for the next week (within the phonological pattern designated from phonological assessment results). For example, if the current pattern is /s/ clusters, the clinician models words with various /s/ clusters (e.g., spot, store, snow). The cluster that the child produces most successfully becomes the target for the ensuing week.

Parents receive the listening list and the production-practice picture cards and are asked to provide two minutes of home practice every day.

Do a web search to find many resources and information about this approach.

Language-Based Intervention
- Many children with speech sound disorders also have difficulties with other aspects of language.
- There is an intricate web of inter-dependencies between various aspects of language.
- Some studies have shown that moderately severe children may improve in phonology and other language domains with a combined phonological/language approach.
- Children who are more severe may need focused attention directly on both domains.
- Cycles approach to language and phonological therapy has been shown to be effective.
- Work on language for one cycle, phonology for the next cycle.
- Work on morphology can also help with phonology (plural, possessives, past tense, etc.)

Other Approaches:
- PACT (Parents & Children Together); Psycholinguistic (using reading methods); Nonlinear Phonology; Core Vocabulary

**SOME PRINCIPLES OF PHONOLOGICAL THERAPY**
- The treatment is based on a phonological assessment, and the aims are defined by the phonological assessment.
- Therapy is based on the principle that there are regularities in the child’s pronunciation patterns (i.e., “order in disorder”).
- Therapy is based on the principle that the primary function of phonological organization is communicative (i.e., differences in sounds and sequences signal meaning differences).
- Therapy aims to facilitate change in the child’s pronunciation patterns in order to build up a more adequate system of sound contrasts and sound structures.
- Therapy is designed to make maximally effective use of the organization of phonological patterning in the target system by introducing and establishing changes in the child’s patterns through use of natural classes of contrastive phones and structures.
GENERAL COMMENTS AND SUGGESTIONS FOR THERAPY  
(Based on Hodson, 2011)

• Remediating a pattern, not individual sounds;
  o Successive approximation; Not trained to 90% criteria
• Communication is the goal of training.
  o Successful communication is its own best reward; Misarticulation is iscommunication; Internal rewards, not external rewards
• Use child-led interactive activities.
  o Play-like therapy; Meaningful linguistic contexts
• Phonological acquisition is gradual.
• Work on phonetic problems along with phonological ones.
• Carefully select words and sounds for therapy.
• Children generalize new skills to other targets.

A HELPFUL RESOURCE FOR ASSESSMENT & TREATMENT
Caroline Bowen: http://speech-language-therapy.com/

REFERENCES


Processing Model
Elements Needed for Comprehension and Production of Speech

Mental Dictionary
Stored form for understanding/producing words. Each word has its own “entry”

Linguistic Perception
Identifying the words in “Input” message

Linguistic Encoding
Choosing the words and sounds for “Output” message

Phonetic Decoding
Discriminating the speech sounds in “Input” message

Motor Planning
Planning oral movements to produce desired words

Auditory Sensitivity
Sounds received by auditory system

Articulation
The sounds are actually produced

“Input”
Message transmitted by another speaker

“Output”
Message is produced

Feedback
Speaker hears speech; feels articulators move
Calculating Percent of Consonants Correct (PCC)

Child's Name: ___________________________  Date Administered: ___________________________

Ask the child to repeat the sentence after you. Put a line through any consonant not produced correctly: all deletions, substitutions, and distortions (no matter how subtle). Exclude all vowels, including /æ, ə/.

1. We see one big dog.
   wi si wən big dog
2. Mother talks on the new phone
   məθə ˈtæks ən ˈdə nu fon
3. The baby has a pretty toy.
   də ˈbebi heɪs ə ˈpriti tɔi
4. Mom says, “Sit down.”
   məm ˈsi zət dɔ:n
5. You’ll be fine with teacher
   jʊl bi ˈfain wiθ ˈtiʃər
6. Oh no, the door shut!
   əʊ nu ə dɔr ʃʊt
7. She looks happy.
   ʃi ˈluks ˈheɪpi
8. Some kids are playing.
   ˈsə ˈkɪdz ər ˈpleɪŋ
9. She is looking in.
   ʃi iz ˈlukn ɪn
10. Watch them dance.
    ˈwæt əm ˈdɑns
11. Now he can read.
    nɔ͡u hi kæn rɪd
12. He took dinosaurs.
    hi tɔk ˈdəɪnəsərz
13. Look he can pull.
    lʊk hi kæn ˈpʊl
14. They just made cars.
    ðeɪ dʒæst ˈmeɪd kɑrs
15. Everybody goes around.
    ˈɛvrɪbədi ɡəʊ əˈraʊnd
16. Now he wants water.
    nɔ͡u hi ˈwɑnts wɔtə
17. She fell down.
    ʃi fel ˈdəʊn
18. What is so funny?
    wæt ɪz ˈso ˈfʌni
19. One boy went behind the balls.
   wən bɔɪ ˈwɛnt bɛhrəɪnd da bɔlz
20. She can’t get inside yet.
   ʃi kænt ˈɡet ɪnˈsaɪd jɛt
   aɪ bʁɔt bʌgz ənd θɪŋz
22. Pieces are all over.
   pɪəz ər ol ˈəʊvər
23. He got cold.
   hi ˈɡet kɔld
24. Time to clean up.
   taim tə klin ʌp
25. Put one flower on his head.
   pʊt wən ˈflɔr ən hɪz hɛd
26. We want more food.
   wɛ ˈwɑnt mɔr fud
27. A lady climbed.
   ə ˈleidi klaɪmd
28. All kids work.
   ɔl ˈkɪdz wɜːk
29. Maybe this will move now.
   ˈmeɪbi ˈdɪz wɪl ˈmuːv nɔu
30. They are very tired.
    ˈðe ər ˈvɜri ˈtɔɪəd
31. We’ll rest awhile.
    ˈwɛl ˈrɛst əˈwɛl
32. He can open a door.
    hi kæn ˈɔpən ə dɔr
33. Come into the room.
    kəm ˈɪntu ə ˈrʊm
34. The dog is watching.
    ðə dɔɡ ɪz ˈwɑtʃɪŋ
35. Move the bug off.
    ˈmuv ðə ˈbʌɡ əf
36. Time to go home.
    taim tə ˈɡo hom

273 consonants - [ ] errors = [ ] correct consonants /273 = [ ] PCC

INTELLIGIBILITY ASSESSMENT:
Calculating Percentage of Intelligible Word Score

- Sitting across from the child, say a sentence from one of the lists.
- After stating the sentence, ask the child to imitatively produce the same sentence. Record just the child’s production and not the clinician’s.
- After all 10 sentences are recorded, find 1-3 listeners who are not familiar with this child’s speech.
- Ask the listener(s) to listen to each sentence two times in succession and write down exactly what is heard.
- Guidelines for scoring: (a) Only the words that the child actually says are used to calculate the percentage intelligible score; (b) If more than one listener, the scores are averaged; (c) Give credit to the word if the root is understood by the listener (e.g., “swim” for “swims” is correct); (d) Do not penalize for incorrect morphology or syntax (e.g., score as correct if child says “see” instead of target “saw”).
- Count the number of words correctly and incorrectly identified by the listener(s) to determine the Percentage of Intelligible Word Score.

<table>
<thead>
<tr>
<th>List 1</th>
<th>List 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The baby falls.</td>
<td>1. Daddy runs.</td>
</tr>
<tr>
<td>2. Mommy walks.</td>
<td>2. The baby cries.</td>
</tr>
<tr>
<td>3. The duck swims.</td>
<td>3. The dog eats.</td>
</tr>
<tr>
<td>4. The boy sits.</td>
<td>4. The girl drinks.</td>
</tr>
<tr>
<td>5. Grandma sleeps.</td>
<td>5. The clown falls.</td>
</tr>
<tr>
<td>6. That is a little bed.</td>
<td>6. That is a big bed.</td>
</tr>
<tr>
<td>7. The boy walked to the table.</td>
<td>7. The boy walked to the chair.</td>
</tr>
<tr>
<td>8. My car is blue.</td>
<td>8. My van is green.</td>
</tr>
<tr>
<td>9. He is brushing his teeth.</td>
<td>9. They are playing the drums.</td>
</tr>
<tr>
<td>10. She is taking a bath.</td>
<td>10. She is talking on the phone.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>List 3</th>
<th>List 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Daddy walks.</td>
<td>1. The bear sleeps.</td>
</tr>
<tr>
<td>2. The bunny drinks.</td>
<td>2. Mommy sits.</td>
</tr>
<tr>
<td>3. The dog sleeps</td>
<td>3. The rabbit hops</td>
</tr>
<tr>
<td>4. The girl jumps</td>
<td>4. The cowboy jumps.</td>
</tr>
<tr>
<td>5. Mommy reads.</td>
<td>5. Grandma falls.</td>
</tr>
<tr>
<td>6. That is a brown chair</td>
<td>6. That is a black hat.</td>
</tr>
<tr>
<td>7. The boy is on the table.</td>
<td>7. The boy is under the table.</td>
</tr>
<tr>
<td>8. My airplane is big.</td>
<td>8. My airplane is small</td>
</tr>
<tr>
<td>9. He is tying his shoe.</td>
<td>9. He is painting the chair.</td>
</tr>
<tr>
<td>10. She is brushing her hair.</td>
<td>10. She is cooking dinner.</td>
</tr>
</tbody>
</table>

Age range of typical consonant development. Average age estimates and upper age limits of customary consonant production. The solid bar corresponding to each sound starts at the median age of customary articulation; it stops at the age level at which 90% of all children are customarily producing the sound.

Place a “✓” in the box if the sound is ever produced in the sample. 
Place a “○” in the box if the sound did not have an opportunity to be produced in the sample.

### Place of Articulation

<table>
<thead>
<tr>
<th>Manner</th>
<th>Bilabial</th>
<th>Labiodental</th>
<th>Interdental</th>
<th>Alveolar</th>
<th>Palatal</th>
<th>Velar</th>
<th>Glottal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voicing</td>
<td>-V</td>
<td>+V</td>
<td>-V</td>
<td>+V</td>
<td>-V</td>
<td>+V</td>
<td>-V</td>
</tr>
<tr>
<td>Stop</td>
<td>p</td>
<td>b</td>
<td>-V</td>
<td>d</td>
<td>-V</td>
<td>-V</td>
<td>-V</td>
</tr>
<tr>
<td>Fricative</td>
<td>f</td>
<td>v</td>
<td>θ</td>
<td>δ</td>
<td>s</td>
<td>z</td>
<td>j</td>
</tr>
<tr>
<td>Affricate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>tʃ</td>
<td>dʒ</td>
<td></td>
</tr>
<tr>
<td>Nasal</td>
<td>m</td>
<td></td>
<td></td>
<td>n</td>
<td>-V</td>
<td>-V</td>
<td>-V</td>
</tr>
<tr>
<td>Liquid</td>
<td>-V</td>
<td></td>
<td>l</td>
<td>r</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glide</td>
<td>-V</td>
<td></td>
<td>-V</td>
<td>-V</td>
<td>-V</td>
<td>-V</td>
<td>-V</td>
</tr>
<tr>
<td>1. twin</td>
<td>tw</td>
<td>2. queen</td>
<td>kw</td>
<td>3. sweep</td>
<td>sw</td>
<td>4. pew</td>
<td>pʃ</td>
</tr>
<tr>
<td>----------</td>
<td>----------</td>
<td>----------</td>
<td>----------</td>
<td>----------</td>
<td>----------</td>
<td>-----------</td>
<td>----------</td>
</tr>
<tr>
<td>6. cue</td>
<td>kʃ</td>
<td>7. few</td>
<td>fj</td>
<td>8. view</td>
<td>vʃ</td>
<td>9. music</td>
<td>mʃ</td>
</tr>
<tr>
<td>11. blue</td>
<td>bl</td>
<td>12. clay</td>
<td>kl</td>
<td>13. glue</td>
<td>gl</td>
<td>14. fly</td>
<td>fl</td>
</tr>
<tr>
<td>16. pray</td>
<td>pr</td>
<td>17. bread</td>
<td>br</td>
<td>18. tree</td>
<td>tr</td>
<td>19. drum</td>
<td>dr</td>
</tr>
<tr>
<td>21. grow</td>
<td>gr</td>
<td>22. fry</td>
<td>fr</td>
<td>23. three</td>
<td>ðr</td>
<td>24. shrub</td>
<td>fɾ</td>
</tr>
<tr>
<td>26. stay</td>
<td>st</td>
<td>27. sky</td>
<td>sk</td>
<td>28. smell</td>
<td>sm</td>
<td>29. snw</td>
<td>sn</td>
</tr>
<tr>
<td>31. stray</td>
<td>str</td>
<td>32. screw</td>
<td>skr</td>
<td>33. splash</td>
<td>spl</td>
<td>34. squirrel</td>
<td>skw</td>
</tr>
<tr>
<td>35. wasp</td>
<td>sp</td>
<td>36. west</td>
<td>st</td>
<td>37. ask</td>
<td>sk</td>
<td>38. caps</td>
<td>ps</td>
</tr>
<tr>
<td>40. cats</td>
<td>ts</td>
<td>41. kids</td>
<td>dz</td>
<td>42. box</td>
<td>ks</td>
<td>43. dogs</td>
<td>gz</td>
</tr>
<tr>
<td>45. bathes</td>
<td>ðz</td>
<td>46. combs</td>
<td>mz</td>
<td>47. cans</td>
<td>nz</td>
<td>48. kings</td>
<td>ðz</td>
</tr>
<tr>
<td>50. cars</td>
<td>rz</td>
<td>51. belt</td>
<td>lt</td>
<td>52. cold</td>
<td>ld</td>
<td>53. milk</td>
<td>lk</td>
</tr>
<tr>
<td>55. sharp</td>
<td>rʃ</td>
<td>56. cart</td>
<td>rt</td>
<td>57. card</td>
<td>rd</td>
<td>58. work</td>
<td>rk</td>
</tr>
<tr>
<td>60. barn</td>
<td>rn</td>
<td>61. camp</td>
<td>mp</td>
<td>62. tent</td>
<td>nt</td>
<td>63. hand</td>
<td>nd</td>
</tr>
</tbody>
</table>
# Consonant Cluster Pattern Analysis

**Client's Name:** ____________  **Date:** ____________  **Clinician's Name:** ____________

| Segments: | p | b | t | d | k | g | f | v | ə | s | ʃ | j | ɾ | w | pr | tr | kr | pl | kw |
| Singleton C: | | | | | | | | | | | | | | | | | | | | |
| Word Initial | | | | | | | | | | | | | | | | | | | | |
| C + /w/ | 1 | 2 | 3 | | | | | | | | | | | | | | | | | |
| C + /j/ | 4 | 5 | 6 | 7 | 8 | 9 | | | | | | | | | | | | | | | |
| C + /l/ | 10 | 11 | 12 | 13 | 14 | 15 | | | | | | | | | | | | | | | |
| C + /r/ | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | | | | | | | | | | |
| /s/ + C | 25 | 26 | 27 | | | | | | | | | | | | | | | | | |
| Word Final | | | | | | | | | | | | | | | | | | | | |
| /s/ + C | 35 | 36 | 37 | | | | | | | | | | | | | | | | | |
| C + /s,z/ | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | | | | | | | | | | | |
| /l/ + C | 51 | 52 | 53 | 54 | | | | | | | | | | | | | | | | |
| /r/ + C | 55 | 56 | 57 | 58 | | | | | | | | | | | | | | | | |
| [+ nasal] + C | 61 | 62 | 63 | 64 | | | | | | | | | | | | | | | | |

---

What Intervention Works for Children’s Speech Sound Disorders

Book Recommendations


Website Recommendations


Bowen, Caroline: www.speech-language-therapy.com


Article Recommendations


Logic, Theory and Evidence Against the Use of Nonspeech Oral Motor Exercises (NSOME) to Change Speech Sound Productions in Children

Gregory L. Lof, PhD, CCC-SLP, FASHA

Nonspeech Oral Motor Movements Defined

• NSOMs are motor acts performed by various parts of the speech musculature to accomplish specific movement or postural goals that are not sufficient in themselves to have phonetic identity (Kent, 2015).

Nonspeech Oral Motor Exercises (NSOME) 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, 2008).
• 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, 2008).
• Oral-motor exercises (OMEs) are nonspeech activities that involve sensory stimulation to or actions of the lips, jaw, tongue, soft palate, larynx, and respiratory muscles which are intended to influence the physiologic underpinnings of the oropharyngeal mechanism and thus improve its functions. They include active muscle exercise, muscle stretching, passive exercise, and sensory stimulation (McCauley, Strand, Lof, et al., 2009).

Do SLPs use NSOME? What Kind?

• 85% of SLPs in the USA use NSOME to change speech sound productions (Lof & Watson, 2008); 85% of Canadian SLPs use NSOME (Hodge et al., 2005); 79% in Kentucky (Cima et al., 2009); 81% in South Carolina (Lemmon et al., 2010); 46% in Minnesota (Louma & Collins, 2012); 91% in India (Thomas & Kaipa, 2015).
• 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 misarticulations.

Logical Reasons to Question Using NSOME

• Some logical questions about NSOME* There is evidence that shows that NSOME do not work. Why is it being ignored? *There is NO evidence that shows that NSOME do work. Why is this being ignored? *Why are the materials and procedures used in NSOME not submitted for peer-review scrutiny? *Why are the materials and procedures promoted only in self-published materials and on proprietary websites? *Why do these websites have a section for “testimonials” but not for “research”? *How could one procedure work to remediate so many disparate types of problems? *What are the monetary benefits to the promoters of NSOME?
Theoretical Reasons to Question Using NSOME #1: Part-Whole Training and Transfer

• **Basic questions:** ① Does training on a smaller portion of the articulatory gesture transfer over to the whole gesture? ② Is it more efficient and better for 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 (Kleim & Jones, 2008; Wightman & Lintern, 1985).

• “*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.

Theoretical Reasons to Question Using NSOME #2: Strengthening the Articulatory Structures

• **Basic questions:** ① Is strength necessary for speaking? If so, how much? ② Are the articulators actually strengthened by using NSOME? ③ How do SLPs objectively document weakness of articulators and objectively document supposed increases in strength after NSOME? ④ Do children with speech sound disorders have weak articulators?

• **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).

• “…only a fraction of maximum tongue force is used in speech production, and such strength tasks are not representative of the tongue’s role during typical speaking. As a result, caution should be taken when directly associating tongue strength to speech…” (Wenke et al., 2006).

• **Agility** and fine articulatory movements, rather than strong articulators, are required for the ballistic movements of speaking. NSOME encourage gross and exaggerated ranges of motion, not small, coordinated movements that are required for talking.

• **NSOME 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 NSOME 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. Clark et al. (2009; 2013) and Robbins et al. (2005) have demonstrated ways to increase oral strength.

• **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 NSOME.

• **Only objective measures** (e.g., tongue force transducers, Iowa Oral Performance Instrument [IOPI]) can corroborate statements of strength needs and improvement. Without such objective measurements, testimonials of articulator strength gains must be considered suspect.
• “To assess tongue strength, clinicians commonly hold a tongue depressor beyond the lips and the patient pushes the tongue against the depressor. Strength is rated perceptually, often with a 3-5 point equal-appearing interval scale or with binary judgments of “normal” or “weak” (Solomon & Monson, 2004).

• Preschool children with speech sound disorders may actually have STRONGER tongues than their typically developing peers (Sudbery et al., 2006).

• **Tone vs. Strength.** Muscle tone refers to the resilience or elasticity of the muscle at rest. "Low tone” indicates less contraction of the fibers than typical. Observing low tone does not automatically mean that the child has weakness. Working on strengthening probably will not influence tone (Clark, 2005; 2010).

**Theoretical Reasons to Question Using NSOME #3: Relevancy of NSOME 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 NSOME 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.

**Theoretical Reasons to Question Using NSOME #4: Task Specificity**

• 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.

Research has shown that non-speech movements activate different parts of the brain than does speech movements (Bonilha et al., 2006; Ludlow et al., 2008; Schulz et al., 1999; Yee et al., 2007). This shows that the neural basis of motor control is different for speech and non-speech oral movements.

Bunton (2008) and Wilson, Green, Yunusova, and Moore (2008) provide examples and concepts dealing with the importance of task specificity.

Clark (2005), Kent (2015), and Maas (2016) provide reviews of the use of nonspeech movements and related concepts for oral motor disorders.

Theoretical Reasons to Question Using NSOME #5: 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, Koegel, 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 NSOME 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) and NSOME

- 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 NSOME 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.
- “The focus of intervention for the child diagnosed with CAS is on improving the planning, sequencing, and coordination of muscle movements for speech. Isolated exercises designed to “strengthen” the oral muscles will not help. CAS is a disorder of speech coordination, not strength.” (ASHA Technical Report on Childhood Apraxia of Speech, 2007).
Cleft Lip/Palate and NSOME

- The VP mechanism can be strengthened through exercise (many studies have demonstrated this since the 1960s), but added strength will not improve speech productions.
- “Blowing exercises, sucking, swallowing, gagging, and cheek puffing have been suggested as useful in improving or strengthening velopharyngeal closure and speech. However, multi-view videofluoroscopy has shown that velopharyngeal movements of these nonspeech functions differ from velopharyngeal movements for speech in the same speaker. Improving velopharyngeal motion for these tasks does not result in improved resonance or speech. These procedures simply do not work and the premises and rationales behind them are scientifically unsound.” (Golding-Kushner, 2001).
- Ruscello (2008) evaluates the use of NSOME and craniofacial anomalies in his article.
- Don’t Blow This Therapy Session! See Lof & Ruscello (2013)

NSOME 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.
- It is puzzling why clinicians would use a motor approach for non-motor speech disorders; therapy must target the system that is impacting the speech problem.

NSOME for Children with Dysarthria?

- NSOME are frequently used for acquired dysarthria, but their use is influenced by “folklore” and not by evidence of effectiveness (Mackenzie et al., 2010). Following guidance from adults with acquired dysarthria, “…strengthening exercises are probably only appropriate for a small number of patients” (Duffy, 2013).
- “…weakness is not directly related to intelligibility…” for patients with ALS (Duffy, 2013).
- Based on the adult acquired dysarthria literature, it appears that NSOME are not recommended as a technique that can improve speech productions.

Evidence Against the Use of NSOME

- Evidence-Based Systematic Review: Effects of Nonspeech Oral Motor Exercises on Speech (McCaulley, Strand, Lof, et al., 2009). Purpose was to conduct evidence-based systematic review on NSOME. Only 8 peer-reviewed articles met rigorous criteria for inclusion. “Insufficient evidence to support or refute the used of OMEs to produce effects on speech was found…”

- There are a few studies evaluating the effectiveness of NSOME that are not in peer-reviewed journals; most of these studies were reported at ASHA Conventions. Of the 11 studies available, 10 showed that NSOME were NOT effective as a treatment approach. See Lass and Pannbacker (2008) and Ruscello (2008) for a review of these and other studies. Many references to studies are listed in the reference list.

Evidence Against the Horn Hierarchy

- Reasons to Question Using NSOME in pressure or resistance from one horn to the next. There really is NO hierarchy in the Horn Hierarchy (Jones, Hardin-Jones & Brown, 2011; 2012).
Combining Treatment Approaches

• **Many 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 NSOME portion of combined treatments is irrelevant to speech improvements.

• NSOME probably do not harm the child when used in combination with traditional approaches (however, Hayes [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., NSOME) so as to not waste valuable therapy time with an ineffectual technique.

In Conclusion

• **Potential reasons why NSOME continue to be used (Lof, 2015):** ① The procedures can be followed in a step-by-step “cookbook” fashion; ② The exercises are tangible with the appearance that something therapeutic is being done; ③ There is a lack of understanding the theoretical literature addressing the dissimilarities of speech-nonspeech movements; ④ The techniques can be easily written out to produce; ⑤ There are a wide variety of techniques and tools available for purchase that are attractively packaged; ⑥ Many practicing clinicians do not read peer-reviewed articles but instead rely on unscientific writings; ⑦ SLPs attend non-peer reviewed activities that encourage their use; ⑧ Parents and therapists on multidisciplinary teams encourage using NSOME; ⑨ Frequently, other clinicians persuade their colleagues to use these techniques.

• 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 NSOME.

• **NSOME are 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, to blow “harder” horns, etc. Rather, the goal is to produce intelligible speech.

• **We have been burned before.** Beginning 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.

• **Following the guidelines of Evidence-Based Practice,** evidence needs to guide treatment decisions. Parents need to be informed that NSOME have not been shown to be effective and their use must be considered experimental.

References Pertaining to NSOME


## INTRODUCTION

Nonspeech oral motor exercises (NSOME) are techniques that do not involve speech production but are used to influence speaking abilities. These often include blowing bubbles and horns, tongue pushes/wags/curling, pucker/smile movements and other mouth gymnastics\(^1\). Although often used by many SLPs, the legitimate professional literature refutes the appropriateness of NSOME for intervention to change speech sound productions\(^1\). Parents may request NSOME be used because:  
- Their child’s previous SLP used NSOME,  
- NSOME objectives may already be on the child’s IEP,  
- They have read testimonial information on the internet encouraging NSOME,  
- There is a proliferation of attractively packaged NSOME products available for purchase,  
- Other professionals (e.g., OT, PT) recommend their use,  
- These exercises provide something concrete for parents to do with their children under the guise of “therapy.”

### PARENTS COMMENTS/QUESTIONS | POSSIBLE RESPONSE
--- | ---
**The SLP has my child practicing sticking her tongue in and out and side-to-side before working on speech. Is this a good idea?** | These nonspeech movements will not help with speech because the parts of the brain that control movements for speech are different from the parts that control nonspeech movements. It’s a brain thing\(^2, 6, 10, 25, 27\).  
--- | ---
**My child has a repaired cleft lip/palate. To me it makes sense that blowing must be a good way to get his speech to not come out his nose.** | For over 50 years it has been proven that blowing exercises will not prevent speech from coming out the nose. It is surprising that this technique is still being used!\(^7, 22\).  
--- | ---
**The SLP working with my child says that exercises “warm up” their mouths. What’s wrong with that?** | Because limited strength is needed to speak, warm-up is not necessary. While a few simple mouth movements may provide some focus on the mouth area, they should only be a very minor part of therapy.\(^5, 24\).  
--- | ---
**I have been told that many kids are diagnosed with Childhood Apraxia of Speech. Aren’t these kinds of exercises necessary to help their speech improve?** | Children with CAS need therapy devoted to making speech, not movements that barely mimic speech (because of how the brain organizes information). Children with CAS have “Apraxia of Speech” so speech is what needs to be worked on, not nonspeech tasks.\(^1, 16\).  
--- | ---
**On the internet, I’ve read information provided by experts who say these exercises work and are necessary to help children learn to speak. It is all over the web, so it must be legitimate.** | You must use caution about believing information found on websites. Research shows that a technique works, not opinions, testimonial, and “expert” advice. While these statements may be interesting, they do not prove that the exercises work. Special care should be taken if you are encouraged to buy a product.\(^17\).  
--- | ---
**The last SLP my child had said oral motor exercises will help develop necessary speech awareness. Don’t children need to become aware of their mouth movements in order to improve speech?** | Research has shown that young children have little awareness of mouth movements. Children need to learn how different mouth movements affect speech, not mouth movements that are not speech.\(^13, 14\).  
--- | ---
**My child can move his tongue up and down quickly, so why can’t he make “tongue tip” sounds such as “l” or “t”?** | The tongue can make many different kinds of movements; however, tongue movements for speech are controlled by a different part of the brain than movements that don’t involve speech.\(^5, 3, 26\).
Won’t working on chewing and swallowing help my child speak better? Doesn’t she need to become good at these nonspeech movements before we can work on actually making her talk?  

Chewing and swallowing are unrelated to speaking. Even though the tongue, lips and other parts of the mouth are used for speech and nonspeech movements, nonspeech movements do not influence how she talks. 8, 9, 20, 21

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTs and OTs often use exercises to improve motor skills. Isn’t speech also a motor skill?</td>
<td>Yes, but speech is much more than just a motor skill because it involves communication. Speech is different from other motor tasks. Speech is special because it involves language. Speech motor tasks are organized in the brain in a unique way. 11, 12</td>
</tr>
<tr>
<td>It was recommended that my child receive muscle-based therapy because he has “low muscle tone”. So that must mean his muscles are weak.</td>
<td>Muscle tone and muscle strength are different. Tone refers to the elasticity of muscles at rest. Just because your child has low muscle tone does not necessarily mean that he has weak muscles. Working on strengthening will not have an effect on tone. 3</td>
</tr>
<tr>
<td>My child has something called a “phonological” problem. Why not mouth exercises for this?</td>
<td>Phonological issues are a problem with the language aspects of talking and do not involve simple mouth movements. Your child needs to learn the “rules” of speech/language, and these rules are not learned by mouth movements. Therapy must be done in meaningful communication contexts. 18, 19, 24</td>
</tr>
<tr>
<td>We have fun doing these exercises at home. What can it hurt to do them?</td>
<td>Although these exercises probably won’t harm your child, focused talking time is too valuable to be wasted. Work at home should be based on practicing valuable skills that will improve speaking. 18, 19, 24</td>
</tr>
<tr>
<td>According to the occupational therapist, my child has speech problems because her mouth is not strong enough. So isn’t strengthening the mouth important?</td>
<td>Very little strength is needed to produce speech; agility and coordination are needed, but little strength. Also, it is surprisingly difficult to accurately determine strength. Therefore, any statements about weakness are questionable. 4, 23</td>
</tr>
<tr>
<td>My child is blowing horns in therapy and has progressed from one horn to the next. That is progress, right?</td>
<td>It is progress in horn blowing but not in speech. Blowing and speaking are completely different from each other and doing one well will not have an impact on the other. 15, 26</td>
</tr>
</tbody>
</table>

REFERENCES


© 2017 Gregory L. Lof