Speech Therapy for Errors Secondary to Cleft Palate and Velopharyngeal Dysfunction

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Speech Therapy for Errors Secondary to Cleft Palate and Velopharyngeal Dysfunction

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ABSTRACT

Individuals with a history of cleft lip/palate or velopharyngeal dysfunction may demonstrate any combination of speech sound errors, hypernasality and nasal emission. Speech sound distortion can also occur due to other structural anomalies, including malocclusion. Whenever there are structural anomalies, speech can be affected by obligatory distortions or compensatory errors. Obligatory distortions (including hypernasality due to velopharyngeal insufficiency) are caused by abnormal structure and not by abnormal function. Therefore, surgery or other forms of physical management are needed for correction. In contrast, speech therapy is indicated for compensatory articulation productions where articulation placement is changed in response to the abnormal structure. Speech therapy is much more effective if it is done after normalization of the structure.

When speech therapy is appropriate, the techniques involve methods to change articulation placement using standard articulation therapy principles. Oral-motor exercises, including the use of blowing and sucking, are never indicated to improve velopharyngeal function.

The purpose of this article is to provide information regarding when speech therapy is appropriate for individuals with a history of cleft palate or other structural anomalies, and when physical management is needed. In addition, some specific therapy techniques are offered for the elimination of common compensatory articulation productions.

KEY WORDS: cleft palate, velopharyngeal insufficiency, velopharyngeal incompetence, velopharyngeal dysfunction, compensatory articulation, speech therapy

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As a result of this article, the reader will be able to (1) determine when speech therapy is appropriate for individuals with a history of cleft lip/palate or velopharyngeal dysfunction; (2) identify speech distortions that are obligatory and speech substitutions that are compensatory; and (3) use appropriate treatment strategies for correction of compensatory productions.

SPEECH THERAPY VERSUS PHYSICAL MANAGEMENT

Whenever there are structural anomalies in the cavities of the vocal tract (oral, nasal and pharyngeal cavities), there is a risk for distortions in speech sound production and resonance. These distortions can be classified as either obligatory or compensatory in nature.

Obligatory distortions are those that occur when function (i.e., articulation) is normal, but the abnormal structure causes distortion of the speech sound or resonance. Examples of obligatory distortions are hypernasality or nasal emission that occur secondary to velopharyngeal insufficiency (VPI). An obligatory distortion can occur with sibilant productions when the teeth are in a position to interfere with the air stream, yet tongue placement is normal. It is important to note that obligatory distortions can only be eliminated with correction of the structure. Speech therapy is not indicated because the articulation placement is normal.[1]

Compensatory errors are those that occur when articulation placement is altered in response to the abnormal structure. For example, when there is VPI and therefore a

lack of adequate oral pressure for certain speech sounds, oral placement may be changed to the pharynx where there is adequate air pressure. Thus, common compensatory productions for VPI include pharyngeal fricatives, pharyngeal plosives and glottal stops. Compensatory speech errors can also be developed with other structural anomalies, such as dental malocclusion.

Compensatory speech errors always require speech therapy for correction because articulation placement is abnormal. Some professionals suggest working on compensatory errors prior to the physical correction of the structure. Although changing placement prior to correction of the structure is possible, it is very difficult, time-consuming and therefore, expensive. Even if successful, the change in placement usually results in a loss of intelligibility. Because of these issues, most professionals recommend correcting the structure prior to therapy whenever possible. For example, we would never suggest correcting compensatory productions prior to repairing a cleft palate. For the same reason, VPI should be corrected as soon as possible to provide the child with better speech potential. Once structure is normalized, correction of the compensatory productions is much faster and easier.

A general rule therefore is that if the abnormal speech or resonance is due to abnormal structure, then physical management is indicated. If the speech disorder is due to faulty articulation placement, then speech therapy is indicated. However, there are times when the cause is uncertain. In these cases, it is always best to do a trial period of speech therapy.[2-6] It usually does not take long to determine whether the therapy will be effective. If the individual continues to demonstrate hypernasality or nasal air emission,

even with an improvement in articulation, then surgical intervention should be considered.

Table 1 shows indications for speech therapy versus surgery for correction of hypernasality and/or nasal emission.

SPEECH THERAPY PRINCIPLES

What to do…

The correction of misarticulations that are the functional sequelae of velopharyngeal valving disorders and/or malocclusion is done through standard articulation therapy. The goal of therapy is to correct placement (and sometimes manner) of production.

The speech therapy techniques used with this population are not very different from the techniques that are used in therapy for other speech sound disorders. Therefore, the basic steps of correction are as follows:

- Determine which phonemes to target first based on stimulability testing and the sounds that will have the biggest impact on intelligibility. In some cases, a developmental sequence may not be the best approach. For example, the SLP may start with the /s/ sound when working with a 3 year old in order to promote the development of the other sibilants, rather than starting with a /k/ sound, which would have less of an impact on intelligibility.

- If there are several errors in a class of speech sounds, use a phonological approach. This usually results in faster progress because several sounds can be corrected at once.[7]
- Make sure the child is able to identify the target sound from the incorrect sound. This may require initial work on auditory and visual discrimination between correct and incorrect productions.
- In general, begin with anterior sounds because they are most visible.
- For continuant sounds, start with the voiceless cognate and then add voicing. For plosives, the voiced cognate is easier in some cases.
- Start with the sound in isolation (i.e., /s/) for continuants, or in a consonant-vowel syllable for plosives (i.e., /ba/.)
- Establish correct placement first, and then correct manner (including voicing) of production.
- When transitioning from one sound in a group to the next sound, change only one feature at a time (i.e., placement, manner, voicing or movement).
- When there is difficulty transitioning from the consonant to the vowel, separate the consonant and vowel by adding an /h/ before the vowel (i.e., /p/…/ha/). Gradually, close the time gap between the two in order to achieve the syllable (i.e., /pa/).
- Work on the correct sound in syllables before transitioning to single words.
- In most cases, work on the sound in the initial position of the word before working on other positions. (An exception to this rule is the /r/ sound. Because the final / ɜːʳ/ is a continuant, it should be established first and before the initial /r/ which involves movement.. Then, therapy should target the initial word position.)

- Teach parents/caregivers how to work on speech at home with several short practice sessions (even as little as 10 seconds a session) several times per day. Success depends on the frequency and intensity of practice at home. Give instructions to parents for assistance in establishing carry-over of new sounds into spontaneous speech.

Speech therapy should continue as long as the child is making progress. If hypernasality or nasal emission are persist, despite normal articulation placement, the child should be referred to a craniofacial team or a VPI specialist (not a general practice otolaryngologist) for further evaluation of velopharyngeal function.

What not to do…

In the past, clinicians used oral-motor "exercises," such as blowing, sucking, whistling, cheek puffing, swallowing, and even playing wind instruments, in hopes of strengthening the muscles of the velopharyngeal valve for improved function with speech.[8-15] However, these exercises were found to be ineffective.[16-19] Later research showed significant differences in the velopharyngeal closure patterns of speech and nonspeech activities, suggesting that nonspeech "exercises" could not possibly be effective in improving velopharyngeal function for speech.[20-24] In addition, patients with a history of cleft rarely have a weakness of the musculature. Despite this information and the fact that there is no evidence in the literature to support the efficacy of nonspeech exercises in improving velopharyngeal function,[25] some clinicians continue to incorporate these exercises in treatment due to a lack of knowledge.

Given current knowledge and the need to adhere to evidence-based practice, procedures to avoid in therapy for sequelae of cleft palate or velopharyngeal dysfunction include the following: blowing, sucking, gagging, swallowing, palatal massage, or any type of oral-motor exercise.[26-27]

SPEECH THERAPY TECHNIQUES

Whenever possible, speech therapy techniques should incorporate the principles of evidence-based practice (EBP),[28] which is the integration of current research with practitioner expertise. Unfortunately, there is a dearth of research on specific therapy techniques. Therefore, the following is a sample of techniques based on the experience of this author and others who specialize in this area. For additional information on techniques, the reader is referred to other resources.[26-27, 29]

Glottal Stop: A glottal stop is produced by vocal fold adduction and a sudden release, resulting in a voiced grunt-like sound. A glottal stop is often substituted for oral plosives when there is inadequate oral pressure due to VPI.

1. For tactile feedback, have the child place his hand on his neck during the production of a syllable where he would normally produce a glottal stop. Tell him to feel the "jerk" during production. Then have him feel his neck during a prolonged vowel or a nasal consonant and vowel (i.e., /ma/) in order to feel the difference.
2. For visual feedback, have the child watch his neck in a mirror during production of the glottal stop versus a prolonged vowel or nasal-vowel syllable.
3. Have the child produce voiceless plosives without the vowel. (The glottal stop does not occur until transition to the vowel.)

4. Have the child produce the voiceless plosive and then the vowel preceded by an /h/, which keeps the vocal folds open and prevents the glottal stop (i.e., "p…hhhha" for "pa," and "p…hhhho" for "po"). Gradually decrease the transition time from the consonant to the /h/ plus vowel until the syllable is produced normally without a glottal stop.
5. Once syllables beginning with voiceless plosives are produced easily, move to voiced plosives. Have the child whisper the syllable slowly with an /h/ between the consonant and vowel. Then gradually add "smooth" voicing and transition to the vowel with an inserted /h/.

Pharyngeal or Nasal Fricatives: A pharyngeal or posterior nasal fricative is sometimes used for sibilants (particularly /s/) as a compensatory production. Either of these productions can also occur in the absence of VPI as articulation errors. In either case, this placement will result in nasal air emission. Regardless of the original cause, the methods for correction are the same.

1. Close your teeth and place a straw at the point of your central incisors during production of an /s/ sound. Have the child listen the sound of the airflow through the straw.
2. Have the child close his teeth. Then put the straw in front of his incisors. Have him produce a /t/ sound while trying to push the air through the straw with his tongue. Have him listen for the air going through the straw.
3. Have the child produce a strong /t/ sound without the straw.
4. Then have the child produce the /t/ with the teeth closed. This will result in /ts/.

5. Have the child increase the duration of the production until it becomes /tssss/.
6. Have the child note the position of the tongue and the air stream flowing over the tongue during production.
7. Finally, eliminate the tongue tip movement for the /t/ component.

Hypernasality and Nasal Emission: Hypernasality and nasal emission are usually due to VPI and therefore, ***usually cannot be corrected with speech therapy***.[27] However, if the child has had surgery for VPI and still has residual nasality, this can be due to a lack of movement of the new anatomy. Movement cannot be increased with exercises. Instead, auditory feedback is used to improve velopharyngeal function indirectly.

- Using a straw or listening tube, have the child put one end at the entrance of his nostril and the other end near his ear (Figure 1). When nasality occurs, it is very audible and even loud. The child is then asked to try to make adjustments in articulation to reduce or eliminate the nasality on oral sounds.
- For ongoing therapy, the Oral-Nasal Listener (Figure 2) is far preferable. With this device, both the SLP (and the parent) can hear what the child is hearing and therefore, help to give the child appropriate feedback.

BIOFEEDBACK TECHNIQUES

There are several ways to provide biofeedback of velopharyngeal function. Feedback can be auditory, visual, or tactile-kinesthetic. However, the clinician must keep in mind that ***biofeedback will only be successful if the individual is anatomically and physiologically capable of achieving normal velopharyngeal closure.*** Biofeedback is not appropriate for

individuals with velopharyngeal insufficiency (which is most typical when there is a history of cleft palate) because it cannot change structure.

Nasopharyngoscopy can be used to provide visual biofeedback regarding the actions of the velopharyngeal mechanism during speech,[2, 30-36] although this is not usually practical on a regular basis. Nasometry can be used in therapy to provide the individual with visual feedback regarding the amount of nasality that is generated during speech. This is most useful in remediating phoneme-specific nasal air emission.

TIMETABLE FOR INTERVENTION AND GOALS

When a baby is born with a cleft, the speech-language pathologist (SLP) for the cleft palate/craniofacial team will typically counsel the family on methods of speech and language stimulation.[37] The parents are usually instructed that during the first 3 years, they should concentrate on language stimulation or the *quantity* of speech (how much the child can understand, how many different words the child uses, and how many words are used in utterances and then sentences).

An appropriate time to evaluate the *quality* of speech (articulation, resonance, and intelligibility) and begin treatment (surgery and/or speech therapy) is around the 3rd birthday. At that time, the child is usually talking enough for an adequate assessment and is mature enough to cooperate for stimulability and instrumental testing. Regardless, secondary surgery for velopharyngeal insufficiency/incompetence (VPI) is typically not done before the age of 3 anyway due to airway concerns.[38]

The majority of preschoolers with a history of cleft palate demonstrate delays in speech sound development, despite early surgical repair.[39] If the child demonstrates VPI

at the age of 3, speech therapy can be initiated immediately to work on articulation placement. However, as noted previously, speech therapy is much easier, faster, more cost-effective and less frustrating for the child (and SLP) if the therapy is done after surgical correction of the VPI. The goal of surgery and then speech therapy in the preschool years is take advantage of the critical time of brain development in order to achieve the best speech possible before the child enters school. Of course, progress is much faster if the parents are involved and there is frequent daily practice in-between the therapy sessions.[40-42]

Some school-aged children continue to have misarticulations that require therapy. If there is still hypernasality and nasal emission, the child should be referred back to the cleft/craniofacial team for further physical management. In addition, many school-aged children with a history of cleft have obligatory speech distortions due to malocclusion of the jaws or displacement of the teeth. Unfortunately, the malocclusion of the jaws usually requires surgery, that can't be done until after facial growth is complete (around age 14 for girls and 18 for boys). Therefore, speech may not be totally corrected until that time or shortly after.

The Ultimate Goal of Treatment

In past generations, the goal of treatment for individuals with a history of cleft palate was "acceptable" or "intelligible" speech, because normal speech was usually not obtainable. With increased knowledge and advances in evaluation and surgical treatment techniques, most individuals now born with cleft palate can expect to ultimately attain normal speech.

Therefore, all efforts should be made to achieve normal speech through appropriate treatment whenever possible.

SUMMARY

Individual with oropharyngeal anomalies often have disorders of speech sound production and resonance.[43] There may be obligatory distortions due to the abnormality of the structure alone. In addition, there may be compensatory errors which involve faulty articulation placement. Speech therapy changes abnormal function (articulation), but is not appropriate if the speech distortion that is due to abnormal structure only. When in doubt regarding the cause of the speech characteristics and appropriate recommendations, a trial period of speech therapy can be done to determine the individual's response to therapy.

The therapy procedures for speech errors of patients with a history of cleft or VPI are no different than those used for other placement errors. Oral-motor exercises, including those that involve blowing and sucking, are never appropriate because they are ineffective in improving velopharyngeal function.

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CEU Questions

1. Speech therapy is effective for which of the following?

a. Hypernasality due to VPI

b. Compensatory productions secondary to VPI.

c. Obligatory errors secondary to VPI

d. Nasal emission due to VPI

e. Nasal rustle due to VPI

2. What is the best way to correct phoneme-specific nasal emission on /s/?

a. Surgical intervention

b. Blowing exercises

c. Oral-motor exercises

d. Change articulation placement

e. Increasing oral activity

3. What is the most appropriate method of therapy for children with a history of VPI?

    a. Blowing exercises

    b. Oral-motor exercises

    c. Articulation therapy

    d. Increasing oral activity

    e. Sucking exercises

4. What speech sound can be inserted between the consonant and the vowel when trying to eliminate glottal stops?

    a. /m/

    b. /h/

    c. /i/

    d. /n/

    e. /s/

5. When is biofeedback appropriate for changing velopharyngeal function during the production of certain sounds?

    a. When there are compensatory productions

    b. When there are obligatory errors

    c. When the individual has the anatomy and physiology to be capable of achieving normal velopharyngeal closure.

    d. After secondary surgery for VPI has been done

    e. When there is only a small velopharyngeal opening

Figure 1. Use of a "listening tube" for feedback regarding hypernasality or nasal emission. (*Reprinted with permission from Kummer AW. Cleft Palate and Craniofacial Anomalies: Effects on Speech and Resonance, 2nd Edition. Clifton Park, NY: Delmar, Cengage Learning, 2008.*)

Figure 2. Use of the Oral & Nasal Listener (Super Duper, Greenville, SC) so that the child and speech-language pathologist can hear the amplified hypernasality or nasal emission at the same time. (*Reprinted with permission from Kummer AW. Cleft Palate and Craniofacial Anomalies: Effects on Speech and Resonance, 2nd Edition. Clifton Park, NY: Delmar, Cengage Learning, 2008.*)

Biography:

Dr. Kummer is Senior Director of the Speech Pathology Department at Cincinnati Children's and Professor of Clinical Pediatrics and Professor of Otolaryngology at the University of Cincinnati Medical Center. She gives many lectures and seminars on a national and international level. She is the author of many professional articles, 16 book chapters, an inventor of the Oral-Nasal Listener, and author of the SNAP nasometry test. She is also the author of the text entitled Cleft Palate and Craniofacial Anomalies: The Effects on Speech and Resonance, 2nd Edition, Clifton Park, NY: Delmar Cengage Learning, 2008. Dr. Kummer is an ASHA Fellow.

Table 1 Indications for speech therapy versus surgery for correction of hypernasality and/or nasal emission.

Indications for Speech Therapy: Abnormal articulation • Compensatory articulation productions that developed secondary to VPI, but persist after velopharyngeal function has been corrected. • Abnormal articulation (function) which *causes* phoneme-specific nasal emission or phoneme-specific hypernasality, in the absence of abnormality of the velopharyngeal valve. These errors may be compensatory in nature or just due to articulation mislearning. • Good stimulability for a reduction in nasal emission or hypernasality with a change in articulation placement, suggesting the problem is due to faulty articulation placement. • Hypernasality, variable resonance or nasal emission due to apraxia. • Hypernasality or nasal emission after surgical correction of velopharyngeal insufficiency (VPI), suggesting faulty articulation placement or the lack of movement of the changed anatomy.
Indications for Surgery: Abnormal structure • Hypernasality or nasal emission due to velopharyngeal insufficiency (which is abnormal structure). • Distortions which are NOT due to faulty articulation (function), but due to abnormal structure. • Hypernasality or nasal emission after adenoidectomy, because of the change in structure.