



Speech Therapy Techniques: For Errors related to Cleft Palate or Velopharyngeal Dysfunction

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Velopharyngeal dysfunction (VPD) refers to a condition where the velopharyngeal valve does not close consistently and completely during the production of oral sounds. There are three types of VPD:

- *Velopharyngeal insufficiency (VPI)* is used to describe an anatomical or structural defect that prevents adequate velopharyngeal closure. Velopharyngeal insufficiency is the most common type of VPD because it includes a short or abnormal velum, which occurs in children with a history of cleft palate or submucous cleft.
- *Velopharyngeal incompetence (VPI)* refers to a neurophysiological disorder which results in poor movement of the velopharyngeal structures. This is common in individuals with dysarthria due to cortical damage or velar paresis due to cranial nerve damage.
- *Velopharyngeal mislearning* refers to a lack of velopharyngeal closure on certain sounds due to the use of sounds in the pharynx as a substitution for certain oral sounds.

Children with VPI may demonstrate *hypernasality* (too much *sound* in the nasal cavity), *nasal air emission* (leakage of *air* during consonant production) and *compensatory articulation productions* (*abnormal articulation productions* in the pharynx to compensate for a lack of oral air pressure due to VPI). Children with velopharyngeal mislearning may produce pharyngeal sounds as a substitute for oral sounds (even without a history of VPI). This causes nasal emission due to the placement of production. Differential diagnosis is very important in order to determine appropriate treatment. VPI (both types) requires physical manage (i.e., surgery or a prosthetic device if surgery is not an option). Velopharyngeal mislearning (including the continual use of compensatory productions after surgical correction of VPI) requires speech therapy.

Indications for Speech Therapy

- Speech therapy cannot change abnormal structure and therefore, cannot correct hypernasality or nasal emission due to VPI— even if there is only a small gap! VPI requires physical management (surgery, or a prosthetic device if surgery is not an option).
- Speech therapy can correct placement errors (abnormal function) that *cause* nasal emission or hypernasality, including the following:
 - Compensatory articulation productions secondary to VPI that continue to cause nasal emission after the VPI repair because they are produced in the pharynx
 - Misarticulations that cause phoneme-specific nasal emission or hypernasality
 - Hypernasality or variable resonance due to apraxia

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- Hypernasality or nasal emission following surgical correction. This is because changing structure does not change function. The child may need to learn to use the corrected velopharyngeal valve through auditory feedback.

The following are specific therapy techniques that have been effective at Cincinnati Children's.

Speech Therapy with Uncorrected VPI

If the child has VPI but surgical correction is being delayed due to airway concerns, work can still be done on articulation placement. However, articulation placement is very difficult to learn without adequate oral air pressure. Therefore, a nose plug should be used in therapy, and worn at home during practice and play as much as possible.

Speech Therapy after VPI surgery

Following surgery, the child may continue to have hypernasality or nasal emission, despite normal articulation. This is because changing structure does not change function. The child may need to learn how to use the new structure through auditory feedback. Auditory stimulation and imitation is the "natural" way to learn speech sound production and VP function.

- Work on the speech sounds in repetitive syllables with different vowels (i.e., pa, pa, pa, pa; pee, pee, pee, pee, etc.). Start with the consonants in Group 1. (See groups below.) Make sure the child is mostly successful in eliminating nasality (as heard through a tube) before moving to Group 2, and later to Group 3.
 - Group 1: /p, t, k/
 - Group 2: /b, d, g/
 - Group 3: /f, s, ʃ, tʃ, dʒ/
- Using a "listening tube" (even a bending straw), have the child put one end of the tube in the entrance of a nostril and the other end near his ear. When nasality occurs, it is heard loudly through the tube. Ask the child to try to reduce or eliminate the sound coming through the tube as he produces oral sounds and then words.
- Put the end of the listening tube in the front of the child's mouth and the other end at the child's ear. Have the child try to increase the oral pressure on oral sounds to hear it loudly through the tube.



Listening Tube: Feedback for nasality



Listening Tube: Feedback for oral pressure

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Oral & Nasal Listener¹ (ONL)

The Oral & Nasal Listener¹ (ONL)™ is more effective than a simple tube or straw because it allows both the speech-language pathologist (SLP) and the child to hear the sound at the same time and at the same volume. This makes it much easier to give appropriate feedback to the child. The ONL is also very effective for home practice because it allows the parent and the child to easily distinguish normal from abnormal productions.

- Put the end of the tube in the child's nose for feedback about nasality.
- Put the funnel of the ONL in front of the child's mouth to provide feedback about oral resonance, oral airflow, and oral pressure.



Oral & Nasal Listener
Feedback regarding nasality



Oral & Nasal Listener
Feedback regarding oral pressure and articulation

Nasometry

- If available, the Nasometer² provides excellent visual feedback of hypernasality and nasal emission.

Therapy for Placement Errors

After surgery for VPI, the child may continue to use compensatory productions, which result in continued nasal emission.

- In therapy, begin with awareness of the abnormal production versus the target sound. Give as many clues as possible using visual, tactile and auditory feedback.
- In all cases described below, use a straw, listening tube, or the ONL periodically for auditory feedback.

Glottal Stops

A glottal stop is like a grunt sound that is co-articulated with oral sounds, particularly plosives.

1. Make the child aware of the glottal stop versus the target as follows:
 - While in front of a mirror, have him watch the contraction in his neck when producing the glottal stop versus an /m/sound
 - Have him place his hand on his neck during the productions of a glottal stop to feel the "jerk" versus the smooth voice onset during production of a vowel or the /m/ sound.
 - Have him listen to the difference between the glottal stop and a /g/ sound.

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2. Have the child produce isolated voiceless plosives—without the vowel— while feeling his neck or watching in a mirror. (For voiceless sounds, the glottal stop does not occur until transition to the vowel.)
3. Have the child produce the voiceless plosive /p/ and then a vowel preceded by an /h/. For example, /p...hɑ/ for /pɑ/ and /p...ho/ for /po/. This keeps the vocal folds open during transition to the vowel and prevents the production of the glottal stop. Gradually, decrease the transition time from the consonant to the vowel until the syllable is produced without the glottal stop.
4. Once voiceless consonants are produced, move to voiced plosives. Have the child produce the voiced sound slowly with a breathy voice. Gradually add “smooth” voicing and transition to the vowel with an inserted /h/. Have the child feel his neck for feedback.

Nasalized Vowels or ŋ/l Substitution

Nasalized plosives or vowels can persist after surgical correction of VPI. Nasalized vowels can also occur in children with no history of VPI. This is usually due to an abnormally high posterior tongue position during production of high vowels, particularly /i/ (as in “feet”). This faulty articulation placement causes “phoneme-specific” hypernasality. In addition, some children have phoneme-specific hypernasality due to substitution of ŋ/l. The nasal for oral sound makes connected speech sound somewhat hypernasal.

1. Ask the child to produce a big yawn, which pushes the back of the tongue down and the velum up. Make him aware of the stretch in the back of his mouth.
2. Have the child co-articulate the nasalized sound (vowel or /l/) with the yawn, while feeling the stretch in the back of the mouth.
3. For auditory feedback at the same time:
 - Have the child use a listening tube or the ONL or...
 - Have the child alternately pinch and open the nose during production of the sound. Have the child try to produce the sound so that there is no difference between the two productions.

Nasalized /ə/

The final /ə/ sound is a continuant sound that is produced by articulating the sides of the back of the tongue against the gum behind the molars. The mid portion of the tongue forms a boat-like shape through which sound enters and resonates. If the child raises the entire back of the tongue, the sound becomes an ŋ/ə, which is a nasal substitution for an oral sound.

1. Using your hand, show the child how the shape of the tongue forms a “boat” when producing final /ə/. Note that the back of the tongue has to touch the gums behind the back teeth.
2. With a tongue blade, stimulate both sides of the tongue towards the back. Then stimulate the upper gum ridge behind the molars. Tell the child that these come together for /ə/.
3. Ask the child to make a wide smile while “backing up the boat” to make the tongue touch the gums on each side.

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4. Assist the child with posterior tongue elevation by pushing up against the base of the chin with your middle finger while squeezing his cheeks with your thumb and forefinger. If you feel his tongue push down under the chin, have him relax it so you can push it up.
5. If the child continues to raise the entire back of the tongue for /ə/ resulting in an /ŋ/, have him close his nose during production. That will make the /ŋ/ sound impossible to produce.
6. Once final /ə/ is established, show the child how the tongue tip moves forward for initial /r/. Have the child put his hands on his face while producing the /r/. Tell him to move his tongue forward, but not move his face.

Pharyngeal Plosives

Pharyngeal plosives are usually substituted for k/g. They are produced with the back of the tongue against the pharynx.

1. Establish placement for velar plosives (/k/ and /g/) by starting with an /ŋ/. If the child can't produce an /ŋ/, put a tongue blade on the middle of the tongue and push down and back OR firmly press your thumb under the base of the child's chin to push the back of the tongue up. (This is effective in establishing /k/ and /g/ in other cases as well.)
2. Once /ŋ/ placement is established, have the child achieve the position and then drop the tongue. Work on the up and down movement of the back of the tongue to replace the back and forth movement which occurs with the pharyngeal plosive.
3. Have the child take a breath and place his tongue in an /ŋ/ position. Have him hold and then drop the tongue. This will produce a /k/ sound. (If necessary, pinch his nose closed and then have him drop the tongue.)
4. Once the child can produce the /k/, have him add voice for the /g/.

Phoneme-Specific Nasal Emission (PSNE)

Phoneme-specific nasal emission (PSNE) is the result of the use of either a pharyngeal or posterior nasal fricative as a substitution for other fricatives or affricates. Because of its production in the pharynx, the velopharyngeal valve must open to allow the release of the airflow. Most commonly, this substitution occurs for the /s/ sound, but it can occur on all sibilants. PSNE can be a compensatory production for VPI (and remain after surgical correction), or it can be a learned misarticulation. Regardless of the original cause, the methods for correction are the same.

Start with /s/:

1. Have the child produce a loud /t/ sound.
2. Then have the child produce the /t/ with the teeth closed. This will result in /ts/.
3. Have the child prolong the production until it becomes /tssss/.
4. Have the child note the position of the tongue and the air stream flowing over the tongue tip during production.
5. Finally, eliminate the tongue tip movement for the /t/ component.
 - For /tʃ/, following the above procedure, but make the lips round. You can also have the child try to produce this sound as a loud sneeze with the teeth closed.
 - For /dʒ/, following the above procedure, but add voicing.
 - For /ʃ/, follow steps 1-4 with rounded lips.

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Straw Technique:

1. Place a straw at the point of your own central incisors during production of a sibilant sound. Note the sound of the airflow through the straw.
2. Have the child put a straw in front of his incisors and try to push the air through the straw during production. If necessary, have him start with a /t/ sound and progress to an /s/. Make sure he hears the air through the straw.

Cu- de-Sac Technique:

- Have the child produce the sounds with the nostrils occluded and then open to get the feel for oral rather than pharyngeal airflow.

Listening Tube or Oral-Nasal Listener Technique:

- Have the child put one end of the tube in a nostril and the other end in his ear. Have him produce an oral sound in a syllable that he produces normally. Have him note the lack of air heard through the tube.
- Have the child produce the sound in a syllable that is normally produced with nasal emission. Have him notice the audible air through the tube. Tell the child to try to eliminate that sound.

Palatal-Dorsal Productions

Palatal-dorsal productions (AKA mid-dorsum palatal stops) can be substituted for lingual-alveolars (/t/, /d/, /n/, /l/) and velars (/k/, /g/, /ŋ/). This placement can also be used for sibilants (/s/, /z/, /ʃ/, /ʒ/, /tʃ/, /dʒ/), resulting in a lateral lisp. Palatal-dorsal productions are often compensatory errors as a result of crowding of the tongue tip. This can occur due to an anterior crossbite or Class III malocclusion.

For lingual-alveolars or velars:

1. Have the child bite on a tongue blade so that it is between the canine or molar teeth. Make sure it is back far enough to depress the middle part of the tongue, which prevents a dorsal production.
2. Have the child produce lingual-alveolar sounds (/t/, /d/, and /n/) in front of the tongue blade and velar sounds (/k/, /g/, and /ŋ/) behind the tongue blade.

Or

Have the child achieve placement and then prolong a nasal sound (/n/ or /ŋ/).

1. Have the child work on achieving that placement and then dropping the tongue. This can be done silently.
2. Have the child take a deep breath, achieve that placement, hold it, and then release to produce the plosive. Pinch the nose closed if necessary.

For sibilants:

1. Place a straw at the front of your own closed incisors and produce an /s/. Listen to the air stream as it goes through the straw.
2. Place a straw at the front of the child's closed incisors during production of the /s/ and note the lack of air stream through the straw.

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3. Move the straw to the side of the child's dental arch during production of the /s/, and find the place where the air stream can be heard through the straw.
4. Have the child put the straw at the front of his closed incisors and produce a /t/ while keeping the teeth closed. Tell the child to push the air into the straw at the front of his teeth. Have him prolong the sound until it is a /tssss/.
5. Have the child feel the air flow over the tongue tip and hear the air through the straw.
6. Then have the child achieve that position and prolong the /s/ without using the /t/.
7. Transition to the syllable by inserting an /h/ between the /s/ and vowel.
8. Once the /s/ is established, the same techniques can be used to achieve other sibilant sounds.

General Principles

- Speech therapy cannot correct VPI. Speech therapy can only correct abnormal placement, including compensatory productions that result in nasal emission after VPI is corrected.
- **Do not use blowing exercises, sucking exercises, velar exercises or oral-motor exercises!** The problem is rarely muscle weakness and these exercises do not work!!!
- Use general articulation procedures to establish correct oral placement. In some cases, this may result in the establishment of oral airflow.
- Remember, motor learning is dependent on feedback. Motor memory is dependent on practice. Make sure the child practices frequently at home. Several short sessions each day works best. Success depends on the frequency and consistency of practice between sessions!
- If progress is not being made, discontinue therapy and refer the child to a **craniofacial team** (not a general ENT) for further evaluation of velopharyngeal function. Surgical intervention or surgical revision may be necessary.

Timetable for Intervention

Ages 0 – 3: Concentrate on **quantity** (language)

- Home program with emphasis on language
- Start language therapy if indicated

Ages 3 - 4: Begin evaluating **quality** (speech and resonance)

- Evaluate speech and velopharyngeal function- Refer to a **craniofacial specialist** as needed.
- Start speech therapy or consider surgery as indicated

Goal of Treatment: Normal (not just “acceptable”) speech and resonance

Resources:

- ¹. The Oral & Nasal Listener (ONL) by Super Duper®, Inc. www.superduperinc.com
- ². The Nasometer by KayPENTAX. www.kayelemetrics.com
- ³. Kummer, A.W. (2014). **Cleft Palate and Craniofacial Anomalies: The Effects on Speech and Resonance**, 3rd Edition. Clifton Park: Cengage Learning.
<http://www.cengagebrain.com/shop/en/US/storefront/US;CMGTJSESSIONID=dy19THwNZMm2X2vPr8G0TymhzHKm9zKzwtmB5QpvT0pMHyQh2vqS!158469931?cmd=CLHeaderSearch&entryPoint=storefront&messageType=CLHeaderSearch&fieldValue=kummer>