Evaluation of Speech/Resonance Disorders and Velopharyngeal Dysfunction

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Financial Disclosures

Royalties:


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• **Honoraria**: I receive honoraria for seminars on cleft palate, craniofacial anomalies, resonance disorders, and velopharyngeal dysfunction

• **Consulting**: I receive payment for consulting on business practices of speech-language pathology programs
Course Chapters

1. Perceptual evaluation
2. Intraoral evaluation
3. Instrumental evaluation
1. Perceptual Evaluation
Perceptual Evaluation Outline

• When
• What
• How
• Why
When?

Please redraw.
When to Evaluate VP Function

• Child needs to have...
  • connected speech
  • ability to cooperate for stimulability testing and instrumental assessment
  • adequate airway with no recent airway concerns
• Usually around the age of 3
Caveat: Don’t wait too long!

- Critical period of brain development and speech/language learning
- Consequences of waiting too long
  - Correction will take longer
  - Prognosis is negatively affected
  - Can affect social and emotional development
What to Assess

• Speech sound production
• Nasal emission on consonants
• Resonance on vowels
• Voice (phonation)
Speech Sound Production

- Placement errors
- Phonological (pattern) errors
- Developmental errors
- Compensatory errors or obligatory distortions
Nasal Emission (NE)

• Inaudible, audible, nasal rustle
• Consistent, inconsistent or phoneme-specific
• Effect on pressure-sensitive consonants and utterance length
Causes of a Nasal Rustle

Due to Small, Structural Defect
- Inconsistent
- Occurs on all pressure phonemes
- Occurs on voiceless plosives (p, t, k)
- Increases with utterance length or fatigue

Due to Misarticulation
- Consistent
- Is phoneme-specific
- Occurs only on certain sibilants
- Does not vary with utterance length or fatigue
Resonance

Need to determine the type:

• Normal resonance (normal balance of oral and nasal resonance)
• Hypernasality
• Hyponasality
• Cul-de-sac resonance
• Mixed resonance
Resonance Severity

Types of rating scales:

- Seven point scale
- Normal, mild, moderate, severe
- Present or absent
Phonation

Evaluate for signs of dysphonia:

• Hoarseness
• Breathiness
• Low or high pitch
• Low intensity
How? What are the tools?
How: Speech Samples

- Single word articulation test... are not good!!!
Single Word Tests

Disadvantages:

• We don’t communicate with single words
• Single words represent best production, not typical production
• Speech sound tested can be affected phonemic environment
• Tests are expensive and time-consuming
Recommended Speech Samples

• Prolongation of sounds
• Repetition of syllables
• Counting
• Repetition of sentences
• Connected speech
Production of Single Sounds

To test for:

- **Hypernasality:** Have the child prolong vowels, particularly the low vowel /ɑ/ and high vowel /i/.

- **Nasal emission:** Have the child prolong /s/.

- **Hyponasality, cul-de-sac resonance, or airway obstruction:** Have the child prolong /m/. 

Division of Speech-Language Pathology
Repetition of Syllables

To test hypernasality or nasal emission, use oral consonants with high and low vowels:

- pa, pa, pa, pa, ... pi, pi, pi, pi...
- ba, ba, ba, ba, ... bi, bi, bi, bi...
- ta, ta, ta, ta... ti, ti, ti, ti...
- ka, ka, ka, ka... ki, ki, ki, ki...
- sa, sa, sa, sa... si, si, si, si...
- ša, ša, ša, ša... ši, ši, ši, ši...
Repetition of Syllables

To test hyponasality, use nasal sounds with high and low vowels:

• ma, ma, ma, ma... mi, mi, mi, mi...
• na, na, na, na... ni, ni, ni, ni...
Counting

To test nasal emission:

• Count from 60 to 70

• Repeat 60 or 66 over and over

\[66 = /sɪkstɪ sɪks/\]

• Good combination of plosives and fricatives in blends
Counting

To test hyponasality:

• Count from 90 to 99
• Repeat 99 over and over
Repetition of Sentences

- **p/b**: Popeye plays baseball. Buy baby a bib.
- **t/d**: Take Teddy to town. Do it for Daddy.
- **k/g**: Give Kate the cake. Go get the wagon.
- **f/v**: Fred has five fish. Drive the van.
- **s/z**: I see the sun in the sky.
- **ʃ**: She went shopping.
- **ʧ**: I ride a choo choo train.
- **ʤ**: John told a joke to Jim.
- **l**: Look at the lady.
- **r**: Run down the road. I have a red fire truck.
- **Θ**: Thank you for the toothbrush.
- **Blends**: splash, sprinkle, street
Recommended Speech Samples

• They are faster, easier, and cheaper than single word tests
• They are more valid
Stimulability

• Should provide cues for normal speech placement of misarticulated phonemes to determine stimulability

• Stimulability is a good prognostic indicator for correction with therapy
For non-compliant children…
Ask Either/Or Questions

What do you like best?

• Puppy dogs or kitty cats?
• Baby dolls or teddy bears?
• Cup cakes or cookies?
• Baseball or basketball?
• Dancing or singing?
Key to Perceptual Assessment

Listen very carefully!!!
Low-Tech & “No-Tech” Procedures

Use same type of speech samples to:

• See it
• Feel it
• Hear it
See: Mirror Test
See: Air Paddle
See: See-Scape
Feel: Sides of Nose
Hear: Nose Plugging

- Listen to oral sounds with nose open and closed
- If there is a difference, there VPI
- If there is no difference, the test is inconclusive
How can we hear it the best?
Hear: Stethoscope

- Put the tip of the tube at the entrance of a nostril
- Listen for air or sound through the scope
Hear: Straw

- Same as stethoscope
- Straw is always available and it’s disposable!
Hear: Listening Tube
Prediction of Gap Size

→ Hypernasality, *inaudible* nasal emission, weak consonants, short utterance length, low volume compensatory errors

→ Hypernasality, *audible* nasal emission, weak consonants, may have compensatory errors

→ Audible nasal emission and possibly mild hypernasality

→ Normal resonance, but inconsistent nasal rustle (AKA nasal turbulence)
Prediction of Size of Gap Based on Perceptual Features

![Graph showing the prediction of velopharyngeal gap size based on perceptual features with severity levels and gap sizes labeled.](image_url)
2. Intraoral Evaluation
Intraoral Evaluation

• Can evaluate *oral* structures and *oral* function
• *Cannot* evaluate *velopharyngeal* structure or VP function
• View is well below area of closure
Normal Velum

• Color is pinkish and consistent
• White line (median raphe) down the middle
• Normal uvula
Intraoral Evaluation

Rule out the following:

• Dental malocclusion
• Abnormal position of tongue tip relative to alveolar ridge
• An oronasal fistula if patient has CLP
• Enlarged tonsils
Intraoral Evaluation

Rule out evidence of a submucous cleft:

• Bifid or hypoplastic uvula
• Zona pellucida (bluish area)
• Notch in the posterior border of the hard palate
• Abnormal insertion of muscles, causing an upside-down V-shape with phonation

Top point is anterior, pointing toward the incisive foramen
Cleft and Muscles

A

B
Submucous Cleft
Submucous Clefts
Submucous Clefts
Submucous Clefts
Oronasal Fistula

• Will it affect speech?
Oronasal Fistula vs. VPI

Hard way:

• Occlude the fistula with gum, fruit roll up, or edible paper
Oronasal Fistula vs. VPI

Easy way:

• Compare the degree of nasal emission on anterior sounds (/t/, /s/) with posterior sound (/k/)

• The valving on the /k/ is usually posterior to the fistula. Therefore, airstream will flow across the fistula, not up into it.

• Elevation of the tongue tip on lingual-alveolar sounds, particularly /t/ and /s/, can push airstream up into the fistula.
Oronasal Fistula vs. VPI

Therefore...

• If there is no nasal emission on /k/, but nasal emission on anterior sounds, then nasal emission is due to the fistula.
• If there is nasal emission on /k/, then there is VPI.
Intraoral Evaluation

Rule out the following:

• Evidence of surgery for VPI, if appropriate
Observations of Possible Airway Obstruction

- Audible, strident breathing
- An open-mouth posture and mouth breathing
- Anterior tongue position
- Puffy eyes
- Appearance of pinched nostrils
- Sleep issues including symptoms of OSA
Intraoral Examination Techniques
Intraoral Examination Techniques

• To see the roof of the mouth...use a dental mirror and light
Intraoral Examination Techniques

• To see the back of the mouth and uvula... have the child say /æ/ (as in “bat”) and protrude the tongue
3. Instrumental Assessment
Nasometry

• Measures acoustic correlates of resonance and VP function through a computer-based instrument

• Provides objective data that can be compared to standardized norms
Nasometer Equipment

- Placement of the sound separator plate against the upper lip
- Microphone on top is for the nasal cavity and on bottom is for the oral cavity
Nasometry Procedure

• Sound separator plate is held against upper lip
Procedure

• SLP selects appropriate passages, such as those from the McKay-Kummer Simplified Nasometric Assessment Procedures- Revised (SNAP-R) based on:
  • Patient’s age and speech ability
  • Concern (hyper or hyponasality)
Nasalance Score

• Nasalance is derived from the ratio of acoustic energy output from the nasal and oral cavities of the speaker
• Nasal/(Nasal + Oral) x 100 = Nasalance
• Higher the score, more nasal energy or hypernasality

$N \div (N+O) \times 100 = \text{Nasalance}$
Display of the Speech Signal

- **Nasogram**—a contour display of individual data points in sequence as they are collected in real time during production of a passage
SNAP Test: Nasal Rustle
Video: Nasal Rustle
Video: Audible Nasal Emission
Video: Hypernasality
Video: Hyponasality

Insert NM-47
Videofluoroscopy

- Multi-view video radiographic assessment with speech
  - Lateral view
  - Anterior-posterior (AP) view
  - Base view
Videofluoroscopy: Lateral View
Videofluoroscopy: AP View
Videofluoroscopy: Base View
Nasopharyngoscopy
Nasopharyngoscopy
Videofluoroscopy vs. Nasopharyngoscopy
Videofluoroscopy vs. Nasopharyngoscopy

- Videofluoroscopy:
  - Can see the entire length of the velum and posterior pharyngeal wall
Videofluoroscopy vs. Nasopharyngoscopy

- Nasopharyngoscopy:
  - Can see entire VP valve and other structures (adenoids, medialized carotid, tonsils in the airway, occult submucous cleft, previous VPI surgery)
  - Much better resolution so can see even very small openings
  - Doesn’t require radiation or barium
  - Parent can hold child
Why? Purpose of the Evaluation

• The results of the speech evaluation determine the appropriate treatment
• The surgeon cannot make this determination
Summary

• A perceptual evaluation of speech, resonance, and velopharyngeal function can be done successfully around the age of 3.

• The perceptual evaluation of speech should include an assessment for obligatory distortions and compensatory errors.

• The perceptual evaluation of resonance should be done to determine the type of resonance.
Summary

• Repetition of syllables and/or sentences is the best way to test both speech and resonance.

• To ensure accuracy of your impressions, a straw or “listening tube” can be used to amplify hypernasality and/or nasal emission.
Summary

• An intraoral evaluation should always be done for patients with suspected speech or resonance disorders.

• For the best view, have the patient say /æ/ (as in “bat”) and protrude the tongue.
Summary

• Instrumental procedures are often helpful in evaluating speech or resonance.

• Nasometry provides objective data regarding the acoustics of resonance.

• Nasopharyngoscopy is the best procedure for direct visualization of the velopharyngeal valve.
Summary

• For more information and additional videos, go to the following:

http://www.jblearning.com/catalog/9781284149104/
Resources


- Cleft Lip and Palate. [https://www.asha.org/Practice-Portal/Clinical-Topics/Cleft-Lip-and-Palate/](https://www.asha.org/Practice-Portal/Clinical-Topics/Cleft-Lip-and-Palate/)


  - Chapter 11. Speech and resonance assessment.
  - Chapter 12. Orofacial examination
  - Chapter 13. Instrumental procedures
  - Chapter 14. Nasometry
  - Chapter 15. Videofluoroscopy
  - Chapter 16. Nasopharyngoscopy