HELLO!

We are speech-language pathologists at the Cleft Palate/Craniofacial Clinic at BC Children’s Hospital.

Outline

- Introduction to the Cleft Palate Team
- Review of Cleft Lip and Palate
- Velopharyngeal Dysfunction (VPD)
- Assessment of Speech and Resonance
- Therapy for Cleft Palate Speech Disorders
Cleft Palate Team
BC Children’s Hospital

Who’s on the team?

- Speech Pathologist
- Plastic Surgeon
- Orthodontist
- Nurse Clinician
- Pediatrician
- Otolaryngologist
- Audiologist
- Social Worker
- Oral surgeon
Who do we see?

- Children born with cleft lip, cleft lip / palate, and cleft palate only (referred at birth)
- Children born with craniofacial conditions (referred normally around 2 or 3 years)
- Referrals from speech pathologists, doctors, dentists

Who do we see?

- SLPs on the team see the children:
  - pre-palate repair (between 9 - 12 months)
  - post-palate repair (18 – 24 months)
  - every 1 to 2 years or more often as needed until speech is no longer a concern

Types of Clefts

Brief Overview
Types of Clefts

- Bilateral or Unilateral
- Lip only
- Lip and Palate
- Palate only
- Partial or complete

Child with left unilateral complete cleft lip and palate - before and after lip repair

Child with a bilateral complete cleft lip & palate
Types of Clefts

You want to do what?

Cleft of the secondary palate

Types of Clefts

Structural features:
- bifid uvula, bluish zona pellucida, notch in the hard palate
- all or some may be present
- may or may not be symptomatic

Types of Clefts-Submucous cleft
Syndromes related to Cleft

- Syndromes account for 15% of cleft lip and palate conditions and nearly 50% of cleft palate alone.
- Although rare in general, some of the common syndromes associated with clefting are:
  - Pierre Robin Sequence/Stickler’s Syndrome
  - Velo-Cardio-Facial / DiGeorge Syndrome (22q deletion)
  - Van der Woude (lip pits)
  - Apert’s Syndrome

Impact of cleft on hearing

- 90% of our babies get tubes at time of palate repair due to middle ear effusion; then may have additional sets.
- Early years (0 – 5) monitoring of ear health/ hearing is extremely important (especially as this of greatest risk for developing speech problems).
- Cleft babies are prone to eustachian tube dysfunction.

Velopharyngeal Dysfunction

Anatomy and Effects
Muscles involved in velopharyngeal function:

- Levator veli palatini - muscle repaired at the time of surgery
- Palatoglossus
- Palatopharyngeus
- Musculus uvulae
- Superior constrictor - lateral wall movement

Abnormal structure

- submucous cleft palate
- short velum after palate repair
- deep pharynx due to cranial base anomaly
- enlarged tonsils
- nasopharyngeal tumours
- irregular adenoids
Velopharyngeal Incompetence

Abnormal function
- caused by neurogenic or physiological dysfunction
- Could be due to hypotonia
- velar paresis due to cranial nerve injury
- dysarthria due to cerebral palsy

Velopharyngeal Mislearning

Effects of VPI/VPD

<table>
<thead>
<tr>
<th>Primary Effects</th>
<th>Secondary Effects</th>
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<tbody>
<tr>
<td>- Hyponasal resonance</td>
<td>- Nasal grimace</td>
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<tr>
<td>- Nasal air emission</td>
<td>- Hoarseness / nodules</td>
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<tr>
<td>- Weak intraoral air pressure</td>
<td>- Short utterance length</td>
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<tr>
<td>- Compensatory articulations</td>
<td>- Soft voice</td>
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<td>- Poor speech intelligibility</td>
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<td>- Nasal regurgitation</td>
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Assessment of Speech and Resonance

Preparation for treatment
Assessment of Speech and Resonance

- **Perceptual Assessment**
  - resonance balance
  - nasal air emission
  - articulation
  - oral mechanism

- **Instrumental Assessment**
  - nasometry
  - nasendoscopy
  - videofluoroscopy

Resonance

- **Hypernasality**: too much sound resonating in the nasal cavity; detected on vowels and voiced consonants

- **Hyponasality**: perceived with reduced nasal airflow; usually the result of an obstruction in the pharynx and/or nasal cavity

- **Mixed hyper/hyponasality**

- **Cul-de-sac**: when sound gets trapped or is blocked into a small area

Hypernasal

- video
Hyponasal

video

Cul-de-sac

Perceptual Assessment of Resonance

<table>
<thead>
<tr>
<th>PERCEPTUAL SPEECH RATINGS (based on CAPS-A-AM, Chapman et al., 2016)</th>
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<tbody>
<tr>
<td><strong>Hypernasality</strong></td>
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<td>8</td>
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Assessment of Resonance

Nasometry

- Measures acoustic energy emitted from the nose and the mouth during speech
- Calculates ‘r, asala, ce’ (ra, ge from 0 to 100%)

\[ \text{Nasal acoustic energy} = \frac{\text{Nasal + oral acoustic energy}}{100} \]

Nasometry
Nasal Air Emission

- Nasal air escape during the production of speech, primarily oral pressure sounds
- Is distinct from but related to hypernasality;
- Can result in **weak intraoral pressure**
- Can be audible and/or visible

Assessment of Nasal Air Emission

- Audible nasal air emission
  - cli, icia, ‘s ear
  - listening tube (can use a straw)

- Visible nasal air emission
  - mirror, reflective surface
  - See-scape
Assessment of Nasal Air Emission

- Mirror video PSNE

Causes of Nasal Air Emission

- VPD
- Fistula
- VPD + Fistula
- Mislearning (phoneme – specific nasal air emission)

Speech Sound Assessment
Speech Sound Assessment

- Depends on speech skills of child
  - Sustained vowels, CV syllables, single words, sentences, conversational speech

- Younger children:
  - Sound inventory?
  - Are there pressure sounds? Only low pressure sounds, nasals, vowels?

<table>
<thead>
<tr>
<th>Errors Suggestive of VPD</th>
<th>Developmental Errors</th>
<th>Distortions</th>
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<td>• Glottal Stops</td>
<td>• Fronting</td>
<td>• Lateralized /s/</td>
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<tr>
<td>• Nasal Fricatives</td>
<td>• Cluster Reduction</td>
<td>• Mid-palatal</td>
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</tbody>
</table>
Instrumental Assessment: Naso-endoscopy

Naso-endoscopy

Naso video (IB short naso)

Instrumental Assessment: Video-fluoroscopy
Videofluoroscopy video (RH Fluoro)

Compensatory Misarticulations

- Glottal stops, glottal fricatives
- Pharyngeal stops, pharyngeal fricatives, affricates
- Mid-dorsum palatal stops
- Velar fricatives
- Nasal fricatives
Children have two main responses to VPD

- **Passive:**
  - Do nothing
  - Maintain articulation while air and sound are passing through the nose
  - These children will say “myme” instead of “baby”

- **Active:**
  - Children will attempt to “compensate” for the VPD i.e., reduced oral pressure, by using alternative places of articulation
  - E.g., Substitute oral pressure sounds with sounds produced inferior to the VP valve (e.g., glottal stop)
  - Substitute oral fricative with nasal fricative
Compensatory Misarticulations

Compensatory Phonological Errors

- Glottal stops
- Glottal fricatives
  /h/

Compensatory Phonological Errors

- Pharyngeal fricatives
- Pharyngeal stops
- Pharyngeal affricates

Compensatory Phonological Errors

- Nasal fricatives
  (Rule out phoneme specific nasal air emission)
Compensatory Misarticulations

Videos of KB, KP, and CB

Guide for Treatment

Guide To Treatment Decision-Making For Cleft-Type Speech
Adapted from Treat Cardenosa (2003)

Perceptual Speech Findings

- Hypernasality
- Audible nasal emission +/- developmental articulation errors
- Hypersensitivity
- Reduced speech power
- Nasalization of inappropriate articulation
- Compensatory articulations due to hypersensitivity or audible nasal emission
- PNE only
- Minimal or no hypersensitivity

- Start speech therapy for developmental errors
- Refer for cleft palate team evaluation, VP imaging study, and consideration of surgical management
Guide for Treatment

- Hypernasality
- Reduced speech power
- Normal/age-appropriate articulation

- Refer for cleft palate team evaluation, VP imaging study, and consideration of surgical management
- Speech therapy not indicated

- not necessarily the case

Guide for Treatment

- Compensatory articulations +/- hypernasality or audible nasal emission

- Start speech therapy to target compensatory errors
- Refer for cleft palate team evaluation and VP imaging study, if there are any oral pressure targets

Guide for Treatment

- PSNE only
- Minimal to no hypernasality

- Start speech therapy to target PSNE
- If unsure of diagnosis or if poor progress after a few sessions, refer to cleft palate team SLP to confirm diagnosis

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Surgical options

Video on surgeries

Prosthetic Management

- Multiple surgical failures
- Airway concerns
- Surgical risk
- Neuromuscular etiology
- TBI or post cancer (nasopharyngeal tumour)
- Or case of the “Black Hole”
- with severe hypernasality and audible nasal air emission, no palate or lateral wall movement

- Recommend Prosthesis

Video on speech bulb
Therapy for Speech and Resonance

What do we do now?

Early Intervention

- Start early !!!
- You want to encourage correct articulatory placement as soon as possible
- Systematic Review of Early Intervention (Meinusch and Romonath 2011)
  - Most studies showed improvement in expressive language after early intervention
  - Better outcomes for kids whose parents were involved in the intervention and it was administered in a naturalistic environment.

Early Intervention

Before palate repair

Vowels, nasals and low pressure sounds

/m/ /n/ /l/ /w/

Focus on open vowels, encouraging lip and tongue movement
Early Intervention

Parent Training

Language stimulation strategies

Oral sound production vs compensatory

Ways to elicit oral sounds

Provide target words (e.g., yum, num, yay/yeah, wow, oh no, meow, moo, mine, more, wawa (water), owie

Parent Training

After palate repair:
- Increase repertoire of oral consonants
  - p, b, t, d, k, g, f, s, z
  - Target greater variety of CV, CVC, CVCV forms
- Combine speech and vocabulary goals
- Still focused on early language stimulation strategies, e.g., imitation, ↓ questions, etc...
Therapy for compensatory misarticulations

- Do I have to work on them? **Yes!**

- Should you wait until after the VPD surgery? **No!**

- Should be targeted as soon as identified.

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**WHY???

- They habituate very quickly
- They won’t just readily develop into target phonemes without therapy
- They stop oral airflow – even after surgical correction of VPD
- They interfere with accurate assessment of velopharyngeal function

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**Therapy Principles**

*Systematic Review of therapy (Bessell et al., 2013)*

**Motor**

- Oral movements
- Sucking, blowing
- Lip tongue movements

**Articulatory approach**

- Plus EPG feedback

**Linguistic**

- Focused stimulation
- Phonological

- Whole language
Therapy Principles
Systematic Review of therapy (Bessell et al., 2013)

- Not enough evidence to support one type of intervention over the others
- Not enough evidence for the efficacy of non-speech motor movement therapy
- Not enough evidence to determine the ideal amount, location, delivery of services
- Most articulatory and linguistic approaches show some improvement of varying degrees
- None of the studies accounted for bias; therefore, a “green light” intervention could not be recommended

Therapy Principles:
Articulation plus linguistic

M: More, Mama/Mom, Me, Mine, Moo, Meow
N: No-No, Nana, Nice, Num-Num, Nose, Night-Night, Neigh (horse sound)
H: Hi, Hop, Hot, Happy, Hug, Here, Hey, Hat, Head
W: Whoa, Wow, Whee, Want, Wawa/water, Whoops, Wash
Y: Yeah, Yea, Yes, Yippee, Yummy/Yum-Yum, You
B: Bye, Bail, Boo, Bowl, Boo-Boo, Bottle, Baby, Bib, Bite, Beep, Bubble, Book, Baa-Baa, Bath
P: Pop, Pooh, Papa, Peek/Peek-a-Boo, Puppy
D: Dada, Done, Down, Diaper, Duck
T: Two, Toy, Teeth

Therapy Principles
(Peterson-Falzone et al., 2006)

- For compensatory speech errors, traditional articulation therapy is considered “best practice”

- Therapy is focused on perceptual training using auditory, tactile, and visual cues, and self monitoring

- Emphasis is on establishing correct placement by explicit teaching
Therapy Principles
(Peterson-Falzone et al., 2006)

- Teach identity, location, and actions of oral structures:
  - teeth, lips, tongue
- Use a picture, mirror, Mr. Potato, Mighty-Mouth
- Teach sounds and their corresponding structures
  - /p/: lip sound, popping sound, poof sound
  - /t/: tongue sound or teeth sound
  - /s/: snake sound
  - /ʃ/: quiet/windy sound
  - /f/: caution with “bu, y teeth” approach; gentle contact

Therapy Principles
(Peterson-Falzone et al., 2006)

- Motor learning approach is recommended (drills as soon as child is old enough, many repetitions)
- Use hierarchical progression of speech contexts
  - isolation,
  - syllables (CV VC VCV CVC)
  - words
  - phrases, sentences
- Suggest mastery at each level (90%)
- One target at a time and make sure that child has mastered it before moving on to the next
- Frequency??

Target Selection

- Sounds that are most stimulable and easy to cue
- Sounds that will have the most impact on intelligibility
- Consider developmental appropriateness
- Move from front sounds to back (i.e., most visible to least)
- Voiceless before voiced
Oral air flow

General strategy: Teach oral direction of airflow

Soft-blowing exercises
  – bubbles
  – cotton balls, feathers
  – coloured pom poms
  – Kleenex

Games/ Races

Blowing activities to encourage oral airflow

• May need to occlude nose to help teach oral airflow

Photo credit: Lynn Mary James – Children's hospital St. Louis
Oral air flow

- Always giving verbal, visual, tactile feedback about air coming out of mouth

- Working toward shaping that oral air flow into any oral sound

Let's make our air go “POP”!!

- Enthusiastically reinforce when air is coming out of the mouth, e.g., Wow!, you made the pop sound out of your mouth!

Target selection and therapy

Emily alphabet video
JB Snap
JB stimulability
Target Selection for glottal stop

Why?
- Sounds that are most stimulable and easy to cue
- Sounds that will have the most impact on intelligibility
- Consider developmental appropriateness
- Move from front sounds to back (i.e., most visible to least)
- Voiceless before voiced

Awareness of glottal stops

- Teach to discriminate on self and on others
  - Use a mirror
  - Start with hand on throat for smooth voice vs “bumpy” “jerky” voice
  - Mama vs ?ay?ee

Therapy for glottal stops

- Teach to discriminate (auditorily and tactiley)
Therapy for glottal stops

- For a child with no oral pressure sounds:
  - Start with establishing /h/
  - Prolong the /h/ before starting to voice vowel
  - hoe, hay, hi, how, who, he
  - If a glottal pops in at start of the vowel, then whisper

Voiceless plosives with /h/ + V + (target)
- (e.g., hapha hapha hapha)
- the /h/ helps to prevent the glottal stop
- use your visual & tactile cues
- continuous flow - no stopping

Proceed with the principles in mind:
- front to back, voiceless, etc.
  - haaphaa, haathaa, haakhaa

Cautionary note:
- Be mindful of glottal co-articulation; can occur when focusing on oral placement
- Make sure to bring attention to continuous airflow as well (“stop the air with your lips”);
- when glottals occur, go back to /h/ whisper and use your visual cues
When child producing target sound but inserting glottal at vowel onset:

/p/ + /hV/

Emphasize the /h/ onset and gradually move /p/ and /hV/ closer together

Using visual/tactile cues (e.g., hand in front of mouth)

p + hay, p + how, p + hi, etc.
Therapy for glottal stops

“Acevedo Spoke” from Leaders Project

- one way of getting in lots of practice at the syllable level
- CV VC VCV

Start with nasal consonant and shift to oral sound in same place:
- mmmpp mmmbb
- nnntt nnnnd
- ngngkk ngnggg

Therapy for nasal fricative substitutions

Video of EL
Therapy for nasal fricative substitutions

- Remember these are learned errors in which airflow is directed nasally
- Can be present with VPD or without VPD
- Avoid using sound name e.g., /s/, /sh/, /f/, rename sound (tongue sound/ quiet sound/ windy sound)

Wind Sound:

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Auditory Discrimination

Nose sound vs mouth sound

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Therapy for nasal fricative substitutions

If child has /t/, prolong it, stretch it out

тсятся тс

Use what ever visuals you can think of...
Hand/finger signals, markers on paper

Additional tip: strong /t/ open mouth, then close teeth
Therapy for nasal fricative substitutions

Add a straw to amplify the sound

Image source: booksforolds.com

Therapy for nasal fricatives

- /th/ to /s/
- Start with blowing, then stick out tongue tip beyond teeth, then pull back tongue, SMILE
- other sound effects at front of mouth e.g., tongue whistling, during play with pom poms, wind through the trees, tap dripping
- Again – may help to occlude nares during early attempts; gradually fade the prompt

Therapy for nasal fricatives-nose plugs

-
Therapy for nasal fricatives

Video of nasal fricative therapy
JGC

Therapy for pharyngeal fricatives

Video of pharyngeal fricative
GA Pharyngeal

Target selection

1: pharyngeal fricative 2. Velar k/g

Sounds that are most stimulable and easy to cue

Sounds that will have the most impact on intelligibility

Consider developmental appropriateness

Move from front sounds to back (i.e., most visible to least)

Voiceless before voiced
Eliminate pharyngeal fricative/establish /s/

- Same techniques as for nasal fricative
- Auditory discrimination
- Shape oral air stream into target
- Exaggerate anterior tongue placement

Establish velar k/g

- Auditory discrimination
- /ng/ stop flow, drop tongue => K
- All traditional techniques for establishing a velar apply (demonstrate, show pictures, touch soft palate with tongue depressor to show location)

Therapy for Hypernasality

- Due to VPD, a structural problem, so NOT usually the focus of therapy
- Exceptions:
  - Quite mild and intermittent
  - Older children who have had palate surgery or a secondary speech surgery
Therapy for Hypernasality

Structures may be intact but patient does not know how to use them

First Step:

- Auditory Discrimination
  Train awareness of oral vs nasal speech

Use words like:

Nose sound vs mouth sound

Can use minimal pairs, exaggerate the nasality vs oral quality

May May vs Bay Bay
Moe Moe vs Boe Boe
Therapy for Hypernasality

Listening Tube (Feedback for nasal emission)

Listening Tube (Feedback for oral pressure)

Ann W. Kummer, PhD, CCC-SLP Cincinnati Children’s Hospital Medical Center

Therapy for Hypernasality

Oral Nasal Listener

SUPERDUPER Inc.

Therapy for Hypernasality

sock

Credit: Boom Cards, Derek Lew RSLP
Therapy for Hypernasality

Visual feedback
- mirror, spoon, DVD - under nose/in front of mouth
- paper air paddle / Kleenex (use hand for tactile cue)

Other strategies worth exploring:

1. Increase strength of articulatory contacts (over-articulation)
2. Increase volume

Some evidence that these activities help to activate the soft palate muscles and may help to compensate for a very small VP gap
When surgery has been unsuccessful, these are strategies to reduce the perception of hypernasality:

- Increase mouth opening
- Reduce/increase volume
- Use stronger articulatory contacts/over-articulation
- Reduce speaking rate

Oral Motor Therapy

- Generally speaking research does not support oral motor therapy

No sucking, yawning, or horn therapy
When we use BLOWING in therapy, the goal is to teach the child to direct airflow orally (not to strengthen or improve muscles).

Treating Errors Related to Dental/Occlusal Abnormalities

What about a fistula?

Impact depends on the size and location

Nasal air emission? Mid-dorsum palatal stop?
Fistula

- Mid – dorsum palatal stop or fricative

- Produced when dorsum of tongue articulates against palate

- Can be substituted for alveolars /t d n l/, velars /k g/, or sibilants /s z ch s dz/.

Fistula-mid dorsum palatal stop/fricative

- A learned error – won’t automatically resolve after fistula is repaired

- Should be targeted in therapy

- Timing of therapy should be discussed with Cleft Team SLP

- Obturators may help until fistula repaired but worth trying to target

Fistula-mid dorsum palatal stop/fricative

- For /t /d/, placement techniques that elevate tongue tip, keep dorsum down

- Anterior tongue placement can sometimes be helpful

- Or for k/g, depress tip and dorsum of tongue, elevate back
Malocclusions

Malocclusions

- Cross Bite
- Class III malocclusion

- May affect tongue placement for /t/, /d/, /s/, /z/, and labiodental placement for /f/, /v/.
- May give rise to lateralization of sibilants; distortion of /s/, /z/, /f/, /v/.

Malocclusions

- Class II Malocclusion (overbite)
  - May impede with lip closure
  - If severe, can result in sound distortions, especially sibilants
Malocclusions

Treating Errors Related to Dental/Occlusal Abnormalities

- some children will benefit from traditional placement therapy techniques
- if child has oral motor weakness, that is another complication that may limit their adaptability

Compensatory—but adaptive

Acoustically and perceptually acceptable, but produced in an abnormal way

- bilabial fricative for f/v, or reverse f/v
- tongue and upper lip for bilabials (macroglossia, severe class III)
- upper teeth and lower lip for bilabials (severe class II)
References

- Golding-Kushner (2001) Therapy Techniques for Cleft Palate Speech and Related Disorders

Online Resources

- American Cleft – Palate Craniofacial Association
  - https://acpa-cpf.org/acpa-online-learning/
- American Speech and Hearing Association (ASHA)
  - https://www.asha.org/Practice-Portal/Clinical-Topics/Cleft-Lip-and-Palate/
- Speech Pathology.com
  - www.speechpathology.com
- Leadersproject.org (Many great resources – FREE; including video tutorials)