Speech/Resonance Disorders due to Clefts and Craniofacial Anomalies

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Financial Disclosures

Royalties:


• Clinical Device: *Oral and Nasal Listener* (ONL), Super Duper Publications (Patent: Nasoscope)
Financial Disclosures

• **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
Non-Financial Disclosures

None
Lecture Outline

1. Normal structure and function
2. Cleft lip and palate
3. Effects of cleft lip/palate (CLP) on speech and resonance
"Well, Roger's hoping for a male and I'd like a little female. ... But, really, we'll both be content if it just has six eyes and eight legs."
1. Normal Structure and Function
Normal Face
Normal Oral Cavity
Normal Palate
2. Cleft Lip and Palate
Types of Cleft Lip

- Normal
- Complete (into nostril)
- Incomplete
- Bilateral
Unilateral Incomplete Cleft Lip
Bilateral Incomplete Cleft Lip
Unilateral Complete Cleft Lip
Bilateral Mixed
(Incomplete and Complete)
Bilateral Complete Cleft Lip
Bilateral Complete Cleft Lip
Bilateral Complete Cleft Lip
Canine Bilateral Cleft Lip
Lip Surgery Before/After

Before

3 DAYS after
Bilateral Facial Cleft
Canine Midline Facial Cleft
Types of Cleft Palate

- Normal palate
- Soft palate cleft
- Hard palate cleft
- Complete palate cleft
- Bilateral palate cleft
Incomplete Cleft Palate
Complete Cleft Palate
Bilateral Complete Cleft Lip/Palate
Bilateral Complete Cleft Lip/Palate
Canine Bilateral Cleft Lip and Palate
Submucous Cleft

Some or all of the following:

• 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:
Classic stigmata
Submucous Clefts:
Typical, but not “classic”
Occult Submucous Cleft: Only seen on the nasal surface
Basic Cleft Classification

Primary Palate

Secondary Palate
Primary Palate: Cleft Lip (CL) and Alveolus

• Anterior to incisive foramen
• Includes lip and alveolus
• Clefts can be:
  • complete or incomplete
  • unilateral or bilateral
Secondary Palate: Cleft Palate (CP)

- Posterior to incisive foramen
- Includes hard and soft palate
- Clefts can be:
  - Complete or incomplete
Embryology

- Primary palate (lip & alveolus): 7 weeks
- Secondary palate (hard & soft palate): 9 weeks
- Development is independent
Embryological Development

- Alveolar Process
- Lip (into incisive foramen)
- Clefting
  - Embryological Development (incisive foramen out)
- Primary Palate
- Secondary Palate
- Hard Palate
- Incisive Foramen
- Clefting (into incisive foramen)
Embryological Sequence

- Closure begins at incisive foramen and “zips” out (toward the lip and uvula)
- If it stops, there is a cleft from that point on
Embryological Sequence

• Clefting goes from periphery to the incisive foramen
  • Right side of lip may close first (left-sided clefts most common)
  • Oral surface of velum closes first (submucous cleft occurs if not complete)
Embryological Sequence

- Mandible grows forward
- Tongue drops down and goes forward
- Palatal shelves move from vertical to horizontal and begin to close
Pierre Robin Sequence
(Pronounced Robann)

- Micrognathia is the underlying cause:
  - Can be due to mechanical forces in utero
  - Can be part of a syndrome
Pierre Robin Sequence

• Sequence:
  • Micrognathia (small jaw), which causes...
  • Glossoptosis (posterior tongue), which causes...
  • Wide, bell-shaped cleft palate
Pierre Robin Sequence with Cleft Palate Only
Micrognathia
Functional Concerns with Micrognathia

1. Airway
2. Feeding
3. Speech
Treatment of the Airway

• Lay child in prone position
• Glossopexy - suture tongue to bottom lip
• Tracheostomy
• Distraction osteogenesis
Distraction Osteogenesis

• Bone is cut (osteotomy)
• Bone is gradually pulled apart (distraction) with an appliance
• New bone is formed (osteogenesis)
Pre and Post Distraction
Pre and Post Distraction
Causes of Clefts

Multifactorial

• Genetic factors (endogenous)
• Environmental teratogens (exogenous)
Genetic Factors

- Causes a predisposition
- Usually a 3-5% recurrence risk
- Risk depends on racial background
  1. American Indians - highest risk
  2. Asians
  3. Caucasians
  4. Africans - lowest risk
Environmental Teratogens

- Nutritional deficiencies (i.e., folic acid)
- Obesity
- Infections (rubella, CMV)
- Drugs (valium, Dilantin)
- Smoking
- Environmental toxins
- Radiation
3. Effects of Cleft Lip/Palate (CLP) on Speech and Resonance
Basic Principles

Whenever there are abnormalities on the outside of the head (face and/or skull)...

always look for corresponding structural abnormalities on the inside of the head.
Basic Principles

Whenever there are abnormalities on the *inside of the head* (face and/or skull)...

always look for corresponding *functional abnormalities*. 
Basic Principles

- Outside anomalies typically affect aesthetics
Basic Principles

• Inside anomalies typically affect function
  • Feeding
  • Swallowing
  • Speech
  • Resonance
  • Voice
  • Hearing
  • Language
  • Cognition
Craniofacial Anomalies
Craniofacial Anomalies: Holoprosencephaly
Basic Principles

• Structural anomalies can affect speech by causing:
  • Obligatory (AKA passive) distortions
  • Compensatory (AKA active) errors
• Treatment for each is different
Basic Principles

• Obligatory distortions:
  • Function (articulation placement) is normal
  • Speech distortion is due to abnormal structure only
  • Treatment: Correct structure

• Examples:
  • Lateral lisp due to interference of maxillary teeth
  • Hyponasality due to VPI
Basic Principles

• Compensatory errors:
  • Function (articulation placement) is abnormal
  • Articulation placement is altered in response to structural abnormality
  • Treatment: Correct structure and then speech therapy to correct function

• Examples:
  • Lateral lisp to avoid interference of maxillary teeth
  • Pharyngeal fricatives to compensate for VPI
Causes of Abnormal Speech with Cleft Lip/Palate

• Primary Palate
  • Lip deformities
  • Nose and nasal cavity deformities
  • Dental and occlusal abnormalities

• Secondary Palate
  • Hearing loss
  • Velopharyngeal dysfunction (VPD)
Lip Deformities
Short Upper Lip

- Short lip and/or protruding premaxilla
- Due to dysmorphology and/or repair
Short Upper Lip

• Can cause difficulty with bilabial competence at rest
• Can affect ability to produce bilabial sounds (p, b, m)
Nose and Nasal Cavity Deformities
Nasal Cavity Abnormalities

• Deviated septum (esp. with unilateral CLP)
• Stenotic naris due to scarring
• Maxillary retrusion with midface deficiency
Maxillary Retrusion with Midface Deficiency

- Restricts pharyngeal and nasal airway
- Can cause hyponasality or cul-de-sac resonance
Dental and Occlusal Abnormalities
Basic Facts

- Tongue rests in mandible
- Tongue tip needs to:
  - be under the alveolar ridge
  - move during speech without obstruction
- Sibilants or “teeth sounds”: /s, z, ʃ, ʒ, ʧ, ʤ/ are not actually produced by the teeth
Video: Edentulous Speech
Basic Facts

- Most consonants are produced in the anterior portion of the oral cavity
- Abnormalities of the anterior dental arch can interfere with movement of the tongue tip and lips
- Narrow maxillary arch can cause oral cavity crowding and distorted speech and resonance
Dental/Occlusal Abnormalities

May cause:

• Obligatory distortions
• Compensatory errors
Dental Abnormalities

- Ectopic tooth
- Supernumerary or misplaced teeth
- Missing teeth
- Dental open bites
- Crossbites
Ectopic Tooth
Supernumerary or Misplaced Teeth
Missing Teeth

• Teeth are not important for speech production
• Missing teeth per se do not affect speech

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Missing Teeth

- Only an issue if there is small oral cavity size or crowding due to:
  - a low, flat or narrow palatal arch
  - maxillary retrusion
  - macroglossia
Missing Teeth

- Oral cavity crowding causes the tongue to seek an opening...
  - either by using an existing one, or creating one by opening the teeth
Missing Teeth
Open Bite
Anterior Crossbite
Anterior Crossbite
Anterior Crossbite
Anterior Crossbite
Video: Anterior Crossbite
Anterior and Lateral Crossbite
Malocclusion

- Class I normal skeletal occlusion
- Class II malocclusion
- Class III malocclusion
Class II Malocclusion
Class III Malocclusion (with maxillary retrusion and open bite)
Class III Malocclusion
Class III Malocclusion
Palatal-Dorsal Production
AKA Mid-Dorsum Palatal Stop

• Used when there is anterior crowding of the tongue tip
Dental/Occlusal Abnormalities

• Particularly affect:
  • sibilants /s, z, ʃ, ʒ, ʧ, ʤ/

• Can also affect:
  • bilabials /p, b, m/
  • labio-dentals /f, v/
  • lingual-alveolars /t, d, n, l/
Treatment of Abnormal Speech due to Dental/Occlusal Abnormalities

- Orthodontics
- Surgery-usually after facial growth is complete
- Speech therapy for compensatory errors
Palatal Expanders

• Cross bites- anterior and lateral
• Maxillary retrusion
Arch Appliance
Quad Helix Appliance
Rapid Palatal Expander
Tongue Irritation from a Rapid Expander
Effect of Palatal (Oronasal) Fistula on Speech

Depends on:

• Size: Larger are more symptomatic
• Location: Above tongue tip will be symptomatic for tongue-tip sounds
Fistula (alveolar or labial)

- “Intentional” fistula
Palatal (Oronasal) Fistulas
Palatal (Oronasal) Fistula
Palatal (Oronasal) Fistula
Palatal (Oronasal) Fistula

If large enough, can cause:

- Nasal emission
- Hypernasality
- Compensatory articulation
Hearing Loss
Normal Middle Ear Function

- At rest, Eustachian tube is closed
- During swallowing, tensor veli palatini muscle opens the Eustachian tube
  - Releases negative pressure
  - Allows fluids to drain
With History of Cleft Palate

- Tensor veli palatini muscle is abnormal, so tube doesn’t open
- Negative pressure builds
- Fluids can’t drain out
- Causes temporary (conductive) hearing loss
- Can affect articulation and language development in the short term
Treatment of Middle Ear Disease

• Insertion of PE (pressure equalizing) tubes
• Regular otologic (ear) care
• Clefts of the primary palate can include the lip and alveolus. They can be incomplete or complete and also unilateral or bilateral.

• Cleft of the secondary palate can include the uvula, velum and hard palate. They can be incomplete or complete and are always midline.

• Embryological development goes from the incisive foramen outward so clefting goes from the periphery toward the incisive foramen.
Summary

• Pierre Roban sequence begins with micrognathia, which causes glossoptosis, which can cause a wide, bell-shaped cleft palate. Airway, feeding and speech are concerns.

• Visible (outside anomalies) can indicate internal anomalies that can potential impair function.

• Structural anomalies can cause obligatory distortions and compensatory errors.
Summary

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• Visible (outside anomalies) can indicate internal anomalies that can potential impair function.

• Structural anomalies can cause obligatory distortions and compensatory errors.
Summary

- Maxillary teeth are not needed for speech but can interfere with normal speech production if they are in an abnormal position.
- Malocclusion can affect the relationship of the tongue tip to the alveolar ridge, which can have a significant effect on speech production.
Summary

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

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

- American Cleft Palate-Craniofacial Association (ACPA). Family Resources. https://cleftline.org/family-resources/
- Kummer AW. (2011). Disorders of resonance and airflow secondary to cleft palate and/or velopharyngeal dysfunction. Seminars in Speech and Language, 32(2), 141-149.
  - Chapter 10. Speech/resonance disorders and velopharyngeal dysfunction