Non-Financial Disclosure

• Author of the SNAP test for nasometry
• Serve on committees for the American Cleft Palate-Craniofacial Association
• Serve on various advisory boards

Seminar Outline
Cleft Lip and Palate

- Normal structure and function
- Cleft lip and palate (CLP)
- Effects of CLP (and other structural anomalies) on speech

Resonance Disorders and Velopharyngeal Dysfunction

- Normal resonance
- Resonance disorders
- Normal velopharyngeal function
- Velopharyngeal dysfunction (VPD)
  - Velopharyngeal insufficiency (VPI)
  - Velopharyngeal incompetence (VPI)
  - Velopharyngeal mislearning
- Effects of CLP/VPI on speech and resonance
Evaluation and Treatment

• Evaluation
  o Perceptual evaluation
  o Intra-oral evaluation
  o Instrumental evaluation
• Treatment of VPI
  o Surgical procedures
  o Prosthetic devices
• Speech therapy
• Referrals

Normal Structure and Function
Normal Palate

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
Unilateral Complete Cleft Lip (Syndromic)

Bilateral Mixed (Incomplete and Complete)
Bilateral Complete Cleft Lip

Bilateral Complete Cleft Lip
Bilateral Complete Cleft Lip

Lip Surgery Before/After

Before

3 DAYS after
Bilateral Facial Cleft

Types of Cleft Palate
Bilateral Complete Cleft Lip/Palate

Cleft Palate Only
Pierre Robin Sequence
Sequence of Palatal Closure

- 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
- Sequence:
  - Micrognathia (small jaw) which causes...
  - Glossoptosis (posterior tongue) which causes..
  - Wide bell-shaped cleft 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

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)

- Anterior to incisive foramen
- Includes lip and alveolus

Clefts include:
- Complete or incomplete
- Unilateral or bilateral

Secondary Palate: Cleft Palate (CP)

- Posterior to incisive foramen
- Includes hard and soft palate

Clefts include:
- Complete or incomplete
Embryology

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

- Closure begins at incisive foramen and “zips” toward the lip and then the uvula
- If it stops, there is a cleft from that point on
- Clefting goes from out to the incisive foramen
  - Right side of lip may close first (left sided clefts most common)
  - Oral surface of velum closes first (submucous cleft if not complete)

Cause 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)
- Infections (rubella, CMV)
- Drugs (valium, dilantin)
- Environmental toxins
- Radiation
Effects of Cleft Lip/Palate (CLP) (and other structural anomalies) on Speech

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: Typical affect appearance and aesthetics
- Inside anomalies: Typically affect function (cognition, language, speech, resonance, hearing, feeding, swallowing, etc.)
Basic Principles

Structural anomalies can affect speech by causing:

• Obligatory distortions
• Compensatory 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
  – Hypernasality due to velopharyngeal insufficiency
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 CLP

• 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

- Due to dysmorphology and/or repair
Short Upper Lip

• Relative shortening due to protruding premaxilla

Short Upper Lip

• Can cause difficulty with bilabial competence at rest
• Can affect bilabial competence during speech for production of bilabial sounds (p, b, m)
Nose and Nasal Cavity Deformities

Nasal or Nasal Cavity Abnormalities

- Deviated septum, esp. with unilateral CLP
- Nasal cavity blockage or restriction
- Stenotic naris due to scarring
- Maxillary retrusion
Maxillary Retrusion

- Causes midface deficiency
- Restricts pharyngeal and nasal airway
- Can cause hyponasality or cul de sac resonance
Nasal Deformities

- Nasal deformities usually cause nasal obstruction
- 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, sh, zh, ch, j) are not really produced by the teeth

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 teeth
- Missing teeth and open bite
Ectopic Tooth
(note tongue flap)

Supernumerary Teeth
Missing Teeth or Open Bite

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

- Class II malocclusion
- Anterior or lateral crossbite
- Class III malocclusion

Class II Malocclusion
Anterior Crossbite

Anterior Crossbite
Anterior and Lateral Crossbite

Class III Malocclusion
(with maxillary retrusion and open bite)
Class III Malocclusion

Class III Malocclusion
Palatal-Dorsal Production
(used for anterior sounds)

Dental/Occlusal Abnormalities

- Particularly affect:
  - sibilants (s, z, sh, ch, j)
- Can affect:
  - labio-dentals (f, v)
  - lingual-alveolars (t, d, n, l)
  - bilabials (p, b, m)
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 Rapid Expander
Effect of Fistula

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

If large enough, can cause:
- Nasal emission
- Hypernasality
- Compensatory articulation
Ankyloglossia

- Congenital anomaly - noted at birth
- Complete: total fusion between tongue and floor of mouth (rare)
- Partial: lingual frenulum is short or has an anterior attachment near the tongue tip
Functional Characteristics

• With mouth open, patient can’t touch roof of mouth with tongue tip

Functional Characteristics

• Patient can’t protrude tongue past the mandibular teeth or incisal edge of the lower gingiva
Functional Characteristics

- Limits normal lingual movements
- With protrusion attempts, tongue becomes heart-shaped or shows a “notch” in midline

Ankyloglossia
Ankyloglossia

Causes of Tongue Tie

- Unknown
- Very common
- Often not symptomatic
- Changes with growth and time
Effect of Tongue Tie

- Restricts tongue tip mobility
- Can affect feeding
  - Can affect latching on to a nipple
  - Restricts movement of a bolus and clearing of food from sulci and molars

Common Belief

- Tongue tip cannot move well... therefore, this will affect speech
Speech and Resonance Disorders: Ann W. Kummer

Speech

- No evidence in literature that ankyloglossia causes speech defects
- Our experience: Ankyloglossia is highly unlikely to cause speech defects

Common sense approach:
- Need for elevation: /l/
- Need for protrusion: /th/
- These sounds can usually be produced, even with significant tongue tip restriction
- May affect lingual trills (i.e., Spanish /r/)
Speech Problems and Ankyloglossia

• Both are common
• May be a co-occurrence, not a cause-effect relationship
• Consider other causes of speech defect:
  – speech sound disorder
  – oral-motor dysfunction

Cosmetic Effect

• “It looks funny.”
• Has been described as a forked or “serpent tongue”
Other Effect

- French kissing

Frenulectomy

- *Usually not warranted for speech*
- More likely to be warranted for early feeding, bolus manipulation, dental or cosmetic concerns
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
Velopharyngeal Dysfunction (VPD)

• Coming up next…