1. **Speech and Resonance Disorders associated with Clefts and Other Structural Anomalies: Evaluation and Treatment**

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   - Employment:
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     - Author of the text called *Cleft Palate and Craniofacial Anomalies: The Effects on Speech and Resonance*, Delmar Cengage, 2008.
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3. **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
4. **Seminar Outline**
5. **Cleft Lip and Palate**
   - Normal structure and function
   - Cleft lip and palate (CLP)
   - Effects of CLP (and other structural anomalies) on speech
6. **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
7. **Evaluation and Treatment**
   - Evaluation
     - Perceptual evaluation
     - Intra-oral evaluation
     - Instrumental evaluation
   - Treatment of VPI
     - Surgical procedures
     - Prosthetic devices
   - Speech therapy
   - Referrals
8. **Normal Structure and Function**
9. **Normal Face**
10. **Normal Face**
11. **Normal Palate**
12. **Cleft Lip and Palate**
13. **Types of Cleft Lip**
14. **Unilateral Incomplete Cleft Lip**
15. **Bilateral Incomplete Cleft Lip**

16 **Unilateral Complete Cleft Lip**

17 **Unilateral Complete Cleft Lip (Syndromic)**

18 **Bilateral Mixed (Incomplete and Complete)**

19 **Bilateral Complete Cleft Lip**

20 **Bilateral Complete Cleft Lip**

21 **Bilateral Complete Cleft Lip**

22 **Lip Surgery Before/After**

23 **Bilateral Facial Cleft**

24 **Types of Cleft Palate**

25 **Bilateral Complete Cleft Lip/Palate**

26 **Cleft Palate Only**
Pierre Robin Sequence

27 **Sequence of Palatal Closure**
- Mandible grows forward
- Tongue drops down and goes forward
- Palatal shelves move from vertical to horizontal and begin to close

28 **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

29 **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

30 **Cleft and Muscles**

31 **Submucous Cleft: Classic stigmata**

32 **Submucous Clefts: Typical, but not "classic"**

33 **Occult Submucous Cleft: Only seen on the nasal surface**

34 **Basic Cleft Classification**
Primary Palate

Secondary Palate

35 **Primary Palate: Cleft Lip (CL)**
- Anterior to incisive foramen
- Includes lip *and alveolus*

Clefts include:
- Complete or incomplete
- Unilateral or bilateral

36 **Secondary Palate:**

Cleft Palate(CP)
- Posterior to incisive foramen
- Includes hard and soft palate

Clefts include:
- Complete or incomplete

37 **Embryology**
- Primary Palate (lip & alveolus): 7 weeks
- Secondary Palate (hard & soft palate): 9 weeks
- Development is independent

38 **Embryological Development**

39 **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)

40 **Cause of Clefts**

Multifactorial
- Genetic factors (endogenous)
- Environmental teratogens (exogenous)

41 **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

42 **Environmental Teratogens**
- Nutritional deficiencies (i.e., folic acid)
- Infections (rubella, CMV)
- Drugs (valium, dilantin)
- Environmental toxins
- Radiation

43 **Effects of Cleft Lip/Palate (CLP) (and other structural anomalies) on Speech**

44 **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.

45 **Basic Principles**

Whenever there are abnormalities on the *inside* of the head (face and/or skull)… always look for corresponding *functional abnormalities.*

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

47 **Basic Principles**

Structural anomalies can affect speech by causing:
- Obligatory distortions
- Compensatory errors
-
- Treatment for each is different

48 **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

49 **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

50 **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)

51 **Lip Deformities**

52 **Short Upper Lip**

- Due to dysmorphology and/or repair

53 **Short Upper Lip**

- Relative shortening due to protruding premaxilla

54 **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)

55 **Nose and Nasal Cavity Deformities**

56 **Nasal or Nasal Cavity Abnormalities**

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

57 **Maxillary Retrusion**

58 **Maxillary Retrusion**

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

59 **Nasal Deformities**

- Nasal deformities usually cause nasal obstruction
- Can cause hyponasality or cul de sac resonance

60 **Dental and Occlusal Abnormalities**

61 **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

62 **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

63 **Dental/Occlusal Abnormalities**
May cause:
- Obligatory distortions
- Compensatory errors

64 **Dental Abnormalities**
- Ectopic tooth
- Supernumerary teeth
- Missing teeth and open bite

65 **Ectopic Tooth**
(note tongue flap)

66 **Supernumerary Teeth**

67 **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

68 **Missing Teeth**

69 **Open Bite**

70 **Open Bite**

71 **Malocclusion**
- Class II malocclusion
- Anterior or lateral crossbite
- Class III malocclusion

72 **Class II Malocclusion**

73 **Anterior Crossbite**

74 **Anterior Crossbite**

75 **Anterior and Lateral Crossbite**

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

77 **Class III Malocclusion**

78 **Class III Malocclusion**

79 **Palatal-Dorsal Production**
(used for anterior sounds)

80 **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)

81 **Treatment of Abnormal Speech**
due to Dental/Occlusal Abnormalities
- Orthodontics

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

82 **Palatal Expanders**
- Cross bites- anterior and lateral
- Maxillary retrusion

83 **Arch Appliance**

84 **Quad Helix Appliance**

85 **Rapid Palatal Expander**

86 **Tongue Irritation from Rapid Expander**

87 **Effect of Fistula**

Depends on:
- Size: Larger are more symptomatic
- Location: Above tongue tip will be symptomatic for tongue-tip sounds

88 **Fistula (alveolar or labial)**
- "Intentional" fistula

89 **Palatal (Oronasal) Fistulas**

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91 **Palatal (Oronasal) Fistula**

92 **Palatal (Oronasal) Fistula**

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

93 **Ankyloglossia**

94 **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

95 **Functional Characteristics**
- With mouth open, patient can't touch roof of mouth with tongue tip

96 **Functional Characteristics**
- Patient can't protrude tongue past the mandibular teeth or incisal edge of the lower gingiva

97 **Functional Characteristics**
- Limits normal lingual movements
- With protrusion attempts, tongue becomes heart-shaped or shows a "notch" in midline

98 **Ankyloglossia**

99 **Ankyloglossia**

100 **Causes of Tongue Tie**
- Unknown
- Very common
- Often not symptomatic
- Changes with growth and time

101 **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

102 **Common Belief**
- Tongue tip cannot move well… therefore, this will affect speech

103 **Speech**
- No evidence in literature that ankyloglossia causes speech defects

- Our experience: Ankyloglossia is highly unlikely to cause speech defects

104 **Speech**

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/)

105 **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

106 **Cosmetic Effect**
- "It looks funny."
- Has been described as a forked or "serpent tongue"

107 **Other Effect**
- French kissing

108 **Frenulectomy**
- *Usually not warranted for speech*
- More likely to be warranted for early feeding, bolus manipulation, dental or cosmetic concerns

109 **Hearing Loss**

110 **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

111 **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

112 **Treatment of Middle Ear Disease**
- Insertion of PE (pressure equalizing) tubes
- Regular otologic (ear) care

113 **Velopharyngeal Dysfunction (VPD)**
- Coming up next…