I. Early Infant Development

a. Early experiences matter and set the brain architecture for later development. Through “serve and return” interactions positive epigenetic changes can be seen later in life (National Scientific Council on the Developing Child, 2010).

b. “Genes and experiences interact to shape brain architecture and functioning, which develops rapidly in the first few years of life when neuroplasticity is greatest.” (Daelmans et al., 2015, p 23).

c. Distinct profiles of infant behavior can be evaluated at 1-3 days of age (Appleton et al., 2016).

d. Key elements for early intervention include promotion of responsive and nurturing caregiving (Daelmans et al., 2015).

e. Infant driven speech (e.g. rate, pitch) and vocabulary selection (e.g. diminutives) can impact linear vocabulary growth and enhance cognitive function (Cristia, 2013; Ota, Davies-Jenkins, & Skarabela, 2018).

II. Pre-linguistic Speech-Language Development

a. Typical expectations in infancy (Oller, Eilers, Neal, & Schwartz, 1999; McLeod & Bleile, 2003)
   i. 0-6 weeks: reflexive vocalization/crying/fussing
   ii. 6 weeks to 4 months: cooing, laughing, vowels, and glottal sounds
   iii. 4-5 months: syllable babbling
   iv. 6-10 months: canonical babbling with reduplicated syllables “... marks a critical transition in the complexity of early vocalizations” (Scherer, 2017, p. 175).
   v. 7-9 months: Most consonants are stops, nasals, and glides. Alveolar stops are the most common and bilabials begin to increase. (Sosa, 2011)
b. Babbling and its relationship to the development of words

i. The phonological system drives lexical acquisition (Stoel-Gammon, 1998; Sosa, 2011).

ii. Babbling is a reliable marker for early identification of speech-language disorders in children (Stoel-Gammon, 1998; Sosa, 2011).

iii. Young children avoid words with sounds that are difficult to produce (Ferguson & Farwell, 1975).

iv. Young children produce words with the sounds and syllable shapes within their babbling repertoire (Stoel-Gammon & Cooper, 1984; Vihman, Ferguson, & Elbert, 1986).

v. What correlates statistically with babbling? (Stoel-Gammon, 1998; Sosa, 2011)
   • Presence of meaningful speech at 24 months of age
   • Expected age of onset of meaningful speech/first words
   • Vocabulary size at 27 months of age
   • Articulation at 3 years of age
   • Performance on speech and language tests at 5 years of age

vi. Why we target babbling (Schwartz & Leonard, 1982; Morris, 2010)
   • Babbling with consonants facilitates expressive language.
   • Children are selective about the new words they attempt during the first-words stage of development (10-14 months).
   • Toddlers are more likely to produce a new word if the word shape and sounds are similar to those already within the repertoire.
   • The fewer words children have within their vocabulary, the more particular they are about words they will attempt.


Children with cleft palate:

i. Exhibit a delay in the onset of canonical babbling.

ii. Vocalize with a fewer number of canonical babbling syllables.

iii. Display variations in the composition of babbling, including a small consonant inventory, with productions as the extremes of the vocal tract:
   • Produce MORE nasal and low-pressure oral consonants: m, n, h, w, y
   • Produce MORE glottal productions: Grunts & growls
   • Produce FEWER high-pressure oral consonants: p, b, t, d, k, g
   • Tend to AVOID consonants made at the alveolar ridge: t, d, n

iv. Vocalize as frequently as children without cleft palate
v. “Children [with cleft palate] are more likely to produce words with these limited consonant inventories, which may further limit speech sound acquisition.” (Scherer, 2017, p. 176).

vi. Delays and variations in vocal development exist regardless of cleft type or early/neonatal orthodontics.

III. Key Principles of Evaluation
(Chapman, 2004; Chapman, Hardin-Jones, & Scherer, 2013; Hardin-Jones & Chapman, 2018; Molemans, Van Den Berg, Van Severen, & Gillis, 2011; Morris, 2009; Morris, 2010; Paul & Jennings, 1992; Pharr et al., 2000; Scherer, 2016; Scherer, Williams, & Proctor-Williams, 2008; Snyder & Scherer, 2004; Stoel-Gammon, 1989; Thal et al., 1995)

a. Sample pre-linguistic assessment battery in children with cleft lip and/or palate:
   i. History: Medical; Developmental; Hearing; Psychosocial; Parental Concerns
   ii. Behavioral Observations & Play:
      • MacArthur Communicative Developmental Inventories (CDI): Gestures Used
      • Westby Play Scales or Rossetti Infant-Toddler Language Scale (Subtests: Interaction-Attachment; Gestures; Play)
   iii. Oral Mechanism Assessment
   iv. Speech Sample
      Obtained by: Clinician or parent collected video and/or on-line transcription.
   v. Receptive & Expressive Language
      • MacArthur Communicative Developmental Inventories (CDI) (Subtests: Phrases Understood; Vocabulary Comprehension; Vocabulary Production)
      • Receptive-Expressive Emergent Language Test – Third Edition (REEL-3) or Rossetti Infant-Toddler Language Scale (Subtests: Language Comprehension & Language Expression)
   vi. Parent / Caregiver Education

b. Key features of pre-linguistic analysis in children with cleft lip and/or palate: For children who are not talking, assessment is best conducted from an analysis of the vocal sample and should include the following measures:

   i. Developmental stage of vocalization: canonical babbling v. variegated babbling
      • True Consonant Babbling Ratio\textsuperscript{syllables} (TCBR\textsuperscript{\textit{sy}}): 
        \# of true canonical syllables / Total \# of syllables 
        A ratio of 0.15 or greater is the threshold for the canonical babbling stage
   ii. Vocalization diversity / Consonant inventory:
      • Total number of consonants
      • True consonants = Any consonant other than a glide (/w/, “y”), /h/, or glottal stop
      • Sound Types (place; manner)
iii. Vocalization complexity / Syllable characteristics:
   - Mean Babbling Level (MBL)
   - Syllable Structure Level (SSL)

c. Consideration in assessment and analysis following cleft palate repair at, or shortly after, 12 months of age.
   i. Assessment battery remains unchanged, with the exception of a speech-language sample which may include first words.
   ii. Analysis will additionally remain unchanged, with the exception of particular attention to changes in vocal diversity, specifically sounds types:
       - Presence of compensatory substitutions.
       - Presence of nasalization.
       - Presence of high-pressure oral phonemes, specifically stop phonemes.
   iii. Although initial perceptions should be noted regarding resonance and nasal air emission, it is important to remember that a definitive judgement regarding velopharyngeal function cannot be made at this time. Assessment of velopharyngeal function is an ongoing process in the early years following cleft palate repair.

IV. Key Principles of Intervention
(Chapman, Hardin-Jones, & Scherer, 2013; Hardin-Jones, Chapman, & Scherer, 2006; Golding-Kushner, 2001; Howard & Lohmander, 2011; Peterson-Falzone, Hardin-Jones, & Karnell, 2010; Scherer, 2017; Scherer & Kaiser, 2007)

“Early Intervention for children with cleft lip and palate (CLP) has the potential to address early speech and language delays that result from having an insufficient oral mechanism [and reduced hearing skills] to support early speech and language production prior to palate repair and to prevent the emergence of compensatory articulation patterns” (Scherer, 2017, p. 175).

a. Primary goals of early intervention in children with cleft lip and/or palate
   i. Increasing consonant inventory
   ii. Increasing consonant inventory and vocabulary simultaneously
   iii. Increasing awareness of oral airflow, within speech sound production activities rather than oral-motor exercises (e.g. blowing)

b. Key features / approaches toward intervention
   i. Arranging the environment: Create the context for conversation by manipulating, or sabotaging, child preferred activities and materials:
      - Limit the number of toy choices at any one time.
      - Keep toys within view; yet, slightly out of reach.
      - Consider toy storage in clear bins or containers.
      - Consider use of toys which require caregiver help to operate (e.g. Wind-up toys, pull-back cars that go, on/off switches.)
ii. Responsive interaction: The use of joint attention and imitation of the baby’s movements and vocalizations to ultimately promote infant imitation and expansion of caregiver vocalizations.

iii. Focused Stimulation: Intensive modeling and expansion

c. Importance of parent involvement

i. Evidence within the field of speech-language pathology has shown parent-implemented intervention is effective in facilitating language development in children with language impairments (Roberts & Kaiser, 2011), including families with little resources and little to no formal education (Bann et al., 2016) as well as children born with cleft lip and/or palate (Scherer, D’Antonio, & McGahey, 2008).

ii. Parent involvement should extend beyond provision of information or parent observation of clinician-implemented intervention, to parent practice of techniques with feedback from the clinician (Bann et al., 2016; Scherer & Kaiser, 2007; Scherer, 2017)

References:


