Phonation

Development, Representation in Cerebral Palsy, Treatment

Definition

- Voiced sound
- Column of air moves upward in the trachea
- Air flow meets adducted vocal folds – interruption of air flow
- Balance of forces/pressures results in phonation (voice) that can be adjusted in pitch, intensity and quality

Development

- Newborn –
  - total body involved
  - vocalizations closely tied to movement

- Two Months –
  - vocalizations tied to movement
  - variety in cry – increased pitch and loudness

- Three Months –
  - length and quality variations in vocalizations
  - predominant open vowels
  - rhythmical sound play
  - changes in sound with child’s more active play

- Four Months –
  - Sounds directed by movement and position
  - Baby plays with sounds – changing breathing, moving or oral play
  - More differentiated consonant formation

- Five Months–
  - Increased frequency/variety of sounds
  - Babbling
  - Explosive chains (increased intensity)

- Six Months –
  - Starts to imitate repetitive sound sequences
  - Sounds become gradually disassociated at this point
  - Play with volume/sound variation
  - May begin to use more negative expressive

- Seven Months–
  - Sound production beginning to separate from movement
  - Period of non-reduplicated babbling
  - Begins to acquire timing constraints – respiration/phonation/articulation

- Eight Months –
  - Chains of syllables, beginning to produce single syllables
  - First word/word approximation
  - Increased purposeful sound production (imitation)
Nine Months–
- Vocalization fully separated from body movement
- Emerging isolated oral movements in sound production
- Increased purposeful sound production (imitation)

Ten - Eleven Months –
- Greater imitation; reflects increased control and purposeful sound production (feed-forward)
- Increased varied inflection and rhythm in vocal play – jargon
- Variegated babbling

Twelve Months–
- Begin to alter gradual approximations of new words, new sounds produced (feed-back, feed-forward)
- Facial expression and inflection convey considerable meaning
- Speech development may go into quiet phase as walking is practiced

Phonation: Components
- Anterior rib cage - points of mobility
- Posterior rib cage - points of mobility

Respiratory/Phonatory Process
- Phonation: production of sound
- Requirements:
  - Respiratory set
  - Abdominal/postural set to grade release of diaphragm
  - Timing/sequencing of air pressure
  - Alignment of vocal folds
• Role of intercostal length in mobility within the rib cage

Role of transitions in shaping size, position and mobility of the ribcage

• Rectus Abdominus
• External Oblique
• Internal Oblique
• Transversus Abdominus

Abdominals

Diaphragm

• Need for balance of thoracic and abdominal pressure impacts movement
  • Reflux
  • Constipation
  • Gastric Emptying

Respiratory/Phonatory Process

Digestive Issues
Respiratory valve (balance of diaphragm and abdominals) has to be able to set, hold and grade release of air
- Laryngeal valving – create voice
- Articulatory valving – modify voice through movement/contact of lips, tongue, jaw and velum

Hard glottal attack – sudden approximation of vocal folds with phonation, reduced regulation of force
- Melody pattern – smooth rising/falling patterns in voice
- Voice quality – normal voice quality described as non-tense, lacking in extraneous noise, non-breathy, and easily produced

Tense – tightness or tension to voice
- Hoarse – appearance of laryngitis, strained and slightly breathy
- Breathy – vocal fold approximation is weak and poorly timed
- Strangled – tightness with added breathiness, short bursts of phonation

Atypical patterns not observed in developing infant
- Laryngeal blocks (open/closed)
- Weak, quiet voice
- Abnormally high pitch
- Falling – rising melody pattern during crying
Cerebral Palsy – Spastic Type

- Increased nasality
- Hard glottal attack to initiate phonation
- Slow rate of speech
- Monopitch, monoloudness
- Decreased intelligibility with increased length of utterance/communicative exchange and with repetition of utterance

Cerebral Palsy – Spastic Type

- Tight facial expression
- Use of tone to accomplish valving
  - Treatment:
    - Use movement to increase intonation and pitch changes (move out of sagittal plane)
    - Inhibition to facilitate/initiate phonation

Cerebral Palsy – Athetoid/Dystonic Type

- Inappropriate coordination of valving (onset of phonation, voicing, articulation)
- Excessive loudness variation
- Reduced control over pitch variation
- Wider ranges of facial expression
- Tongue movement is more forward: wider ranges of movement

Cerebral Palsy – Athetoid/Dystonic Type

- Oral movement is more constant; more inconsistent
- Entire process is arhythmical – sequencing is greatest difficulty
  - Treatment – increase stability (postural, shoulder girdle, oral) before speech production

Hypotonia

- Decreased active and precise oral movements for speech
- Reduced ability to rapidly sequence oral movements for speech
- Decreased speech intelligibility
- Decreased vocal intensity/respiratory volume

Hypotonia

- May also see decreased motor planning and/or decreased sensory registry
  - Treatment:
    - Activities to alert/arouse respiratory/phonatory system and oral movements
Ataxia

- Considerable difficulty with coordination of processes for phonation
- Patterns of fixing (particularly jaw fixing) that interfere with articulation
- Vocal quality: variable in pitch, breathiness and loudness
- Treatment:
  - Stability and deep proprioceptive input are helpful

Cerebral Palsy: Hemiplegia

- Wide variety of limitations related to phonation/articulation
  - May see apraxia/motor planning issues in some cases
  - May see asymmetry in rib cage
  - May see some degree of oral asymmetry, but not hallmark characteristic

Cerebral Palsy: Diplegia

- General issues of reduced volume and timing/coordination of respiratory/phonatory process impact intelligibility
- Articulation is not typically affected

Treatment

- Step One – Assessment/Analysis
  - Is child able to establish adequate respiratory volume?
  - Adequate mobility within the rib cage?
  - Adequate stability through trunk to counteract forces of diaphragm for gradual release?

- Adequate ability to valve oral/nasal air flow?
- Sensory registration?
- Motivation?
- Intention?
- Cognition?
Treatment Strategies

- Vibration
- Variation in use of vibration as respiratory set
- Movement
- Alignment/position
- Sensory input – arousal, proprioception
- Motivation – must always have reason for phonation
- Intention to communicate – eye contact

Tips in Treatment

- Reinforce any phonation immediately/consistently
- Facilitate automatic phonation vs. directed
- Expect and wait ……
- Initiate voicing activities with family immediately
- Use gravity to advantage