From Feeding to Eating: Assessment and Oral Feeding Interventions for Infants with Tracheostomy Tubes

HOLLY SCHIFSKY, OTR/L, CNT, NTMTC, CBIS

1

Disclosure

Financial: Holly Schifsky receives a speaking fee from Dr. Brown's Medical for teaching this course.

Non-financial: Holly Schifsky has no relevant non-financial relationships to disclose or list other non-financial disclosures (if applicable).

2

Objectives

- **Deduct** — Deduct rationale for infant requirement of tracheostomy tubes and implications on development
- **Determine** — Determine at least two risk factors for feeding dysfunction associated with oral feeding an infant with a tracheostomy
- **Interpret** — Interpret oral feeding behaviors for infants with tracheostomy tubes as typical or atypical during the oral, pharyngeal, and esophageal phase of feeding
- **List** — List at least 2 rationales for infant requirement of tracheostomy tubes and implications on development

3

No photography allowed

The patients' families have given permission for Holly to use their child's photographs and videos for your educational benefit.

The families did not give the audience permission to record those photos and videos. Please respect the families' wishes.

Application and interpretation of material is the responsibility of the treating therapist

4

Introduction

5

Oral Feeding and Eating

Pediatric Feeding Disorder: Impaired oral intake that is not age-appropriate and associated with medical, nutrition, feeding skill, and/or psychosocial dysfunction

Children with tracheostomy tubes have the most severe PFD behaviors

Tracheostomy tubes are often placed following prolonged intubation at young ages

- Increase in oral aversion
- Tracheostomy tube is placed or remains in place during critical windows of feeding skill development, thus impacting sensory and motor development

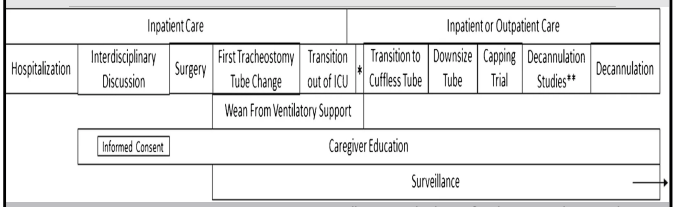
Goday 2019

6

Indications for Infant Tracheostomy Tube

7

Care Plan Map for Neonates with Tracheostomy Tubes



Fuller, C., Wineland, A.M. & Richter, G.T. Update on Pediatric Tracheostomy: Indications, Technique, Education, and Decannulation. *Curr Otorhinolaryngol Rep* **9,** 188–199 (2021). https://doi.org/10.1007/s40136-021-00340-y

8

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN®

From: **Survival and Decannulation after Infant Tracheostomy**

Pediatrics. 2018;142(1_MeetingAbstract):558. doi:10.1542/peds.142.1MA6.558

Lung: 44%
Airway: 39%
Neuro: 6%
Heart: 5%
Other: 4%

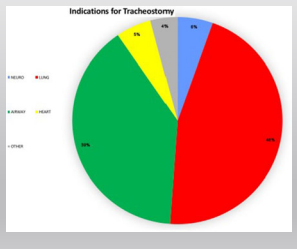
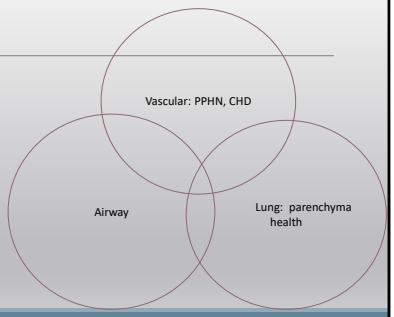


Figure Legend:
Indication for Tracheostomy

9

Lung Pathology



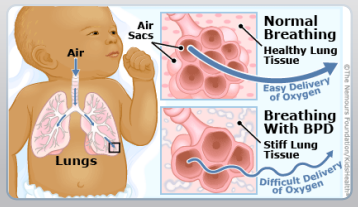
10

Lung Development, Health, and Injury

Bronchopulmonary Dysplasia: Its pathogenesis involves underdevelopment of lung tissue with subsequent limitations in ventilation and oxygenation, resulting in impaired postnatal alveolarization.

Dx at 36 weeks and older if infant continues to require mechanical ventilation

Over 30 days of age and continues to require supplemental oxygen



11

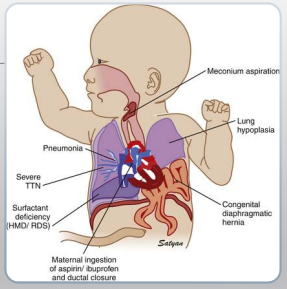
Pulmonary Vascular Disease

BPD subtype of PPHN, affects 25% of infants with BPD

Abnormal vascular remodeling and arrested development or growth of the pulmonary vasculature

This creates increased pulmonary vascular resistance (PVR) that can lead to right ventricular heart failure

Slow onset with pressures measured via ECHO cardiogram



Hansmann 2021

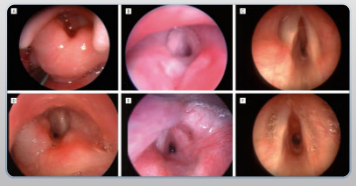
12

Airway

Laryngeal Lesions: ETT places pressure on larynx mucosal surface resulting in ischemia, ulceration, and granulation tissue formation

Subglottic stenosis risk factors for infants:

- Intubation duration
- Unintentional extubation, traumatic intubation
- Sedation: ETT mobilization trauma during times of agitation



Balloon dilation laryngoscopy for subglottic stenosis

Schweiger 2021
Jefferson, 2016
Sun, 2022

13

Anatomical Anomaly or Airway Obstruction

- Pierre Robin Sequence
- Micrognathia
- Treacher Collins
- Goldenhar
- Beckwith Wiedemann
- Lymphatic malformation

Wiechers 2021

14

Neuromuscular Conditions

Diagnosis:

- Myotonic dystrophy
- SMA
- Myopathies
- Genetic conditions
- Neonatal hypotonia

Primary Goals:

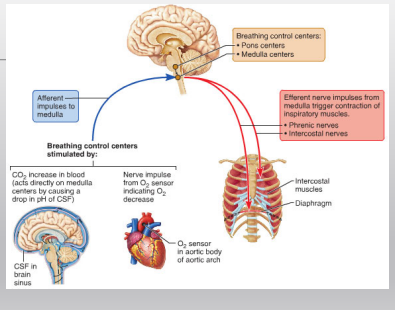
- Pulmonary Hygiene, Pulmonary Health, Airway Clearance, and Cough activation

Praud 2019
Mercuri 2019

15

Neurological Conditions

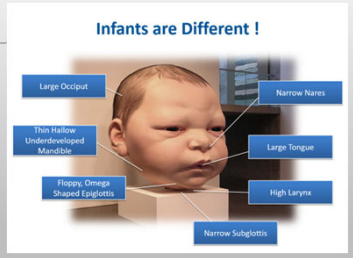
Central neurological condition
- Severe HIE
- Genetic condition with brain anomaly
- Brain injury



16

The Neonatal Airway

Compared to adult, structures are:
- Smaller
- More anterior
- Epiglottis is floppier
- Larger tongue
- Larger occiput
- Narrowest portion of the airway is the cricoid



17

Implications of Infant Tracheostomy Tubes

18

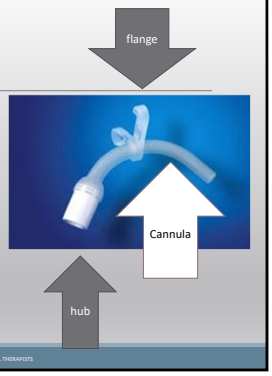
Tracheostomy Tube Components

Cannula: Curved portion of the tracheostomy tube that inserts into the stoma
- Keeps the tracheostoma open; allows for suctioning of secretions

Neck flange: lays against the neck
- Allows the tube to be secured to the neck

Hub: allows the tube to connect to the ventilator, HME (heat/moisture exchange), speaking valve, filter

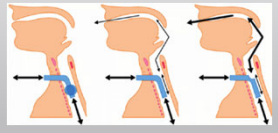
Pilot balloon: found on cuffed tracheostomy tubes



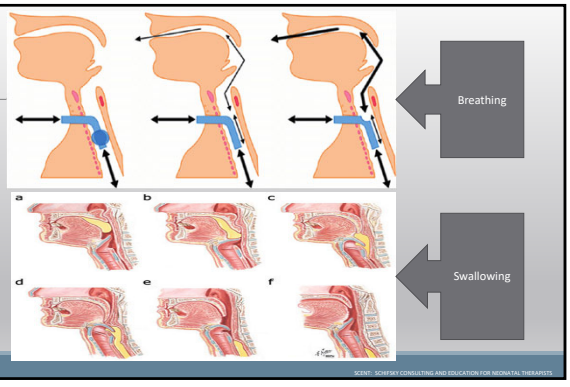
19

Protection of tracheal wall: Continual Monitoring for Optimal Development

The size of the infant tracheostomy tube determines the amount of residual air space within the trachea (air leak) to allow for:
- Audible cough
- Phonation
- Use of HME, valves, cap/plug
- Weaning vent settings
- Swallow (reduced risk of bolus entrapment in esophagus)



20

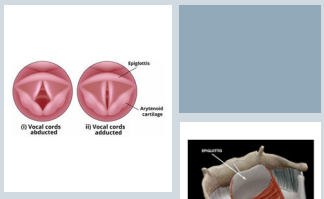


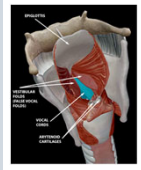
21

Affects of the tracheostomy tube

- Increase risk of aspiration
- No airflow through upper airway
- No subglottic pressure
- Poor sensory development
  - Limited taste/smell
  - Poor sensation of secretion pooling
- Poor laryngeal elevation
  - Cuff trach can stabilize the larynx

22

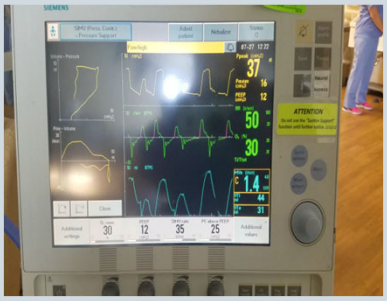




Implications of trach

Inability to adduct vocal cords
- Cords in abducted position
- Poor cough strength
- Poor phonation
- Poor activation of trunk
- Inability to manage thoracic/abdominal pressure
- Reduced ability to stool

23



Ventilator Settings

PEEP: Positive End Expiratory Pressure

Pressure Support

FiO2: Oxygen

Tidal Volume

SCENT: SCHIFSKY CONSULTING AND EDUCATION NEONATAL THERAPISTS

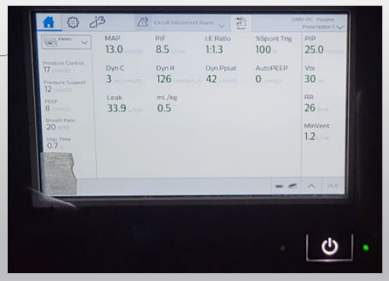
24

Home Vent

Percent spontaneous trigger: muscle activation

AVAPS: Average Volume-Assured Pressure Support

- Maintains tidal volume during REM (increase hypoventilation) and NREM (reduces risk of hyperventilation) sleep
- Quickly modulates pressure support with a higher pressure to activity demands



25

Interventions and Assessment for Oral feeding/eating

26

Guideline for oral feeding progression post-tracheostomy tube placement

Tracheostomy tube is placed

1. 3-7 days of immobility with stay sutures, but OK to start oral motor intervention
2. Once stay sutures removed, advance to out of bed with NNS, secretion management
3. If infant demonstrates secretion management and meets below requirements, advance to oral feeding
   - PEEP of 10 or less on vent (relative recommendation)
   - FiO2 at 50% or less
   - Trach cuff at 1.0mL or less (sterile water or air inflation)
   - Demonstrates hunger cues
   - Tolerates gastric feeding

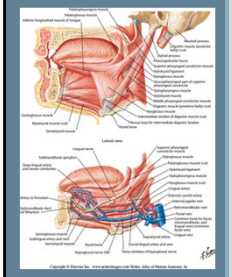
27

Guideline continued

4. Trial of bottle feeding with feeding therapist (recommendation that feeding therapist is trained and competent in tracheostomy tube suctioning)
5. Continue bottle feeding 1x per day with 10mL limit of unfortified breastmilk if available
6. Allow 5-10 days of oral feeding practice with feeding therapist, once infant demonstrates skill advance to VFSS or standardized swallow assessment
7. Completion of VFSS
8. Create oral feeding plan with consideration for:
   - Frequency of attempts
   - Time/volume per attempt
   - Integration of breastfeeding
   - Positioning
   - Bottle selection
   - Family/team training
   - Identify infant stress cues and plan to stop oral feeding attempt
   - cuff

28

Assessment: Oral Phase of Feeding



Anatomical changes due to pulmonary support

Motor and sensory development of intra-oral cavity

Secretion management

29

Intervention: Oral Motor Facilitation

Shape: has the most influence on motor skills and sucking burst of the tongue

Integrity: has the most influence on sensory skills and amplitude

Texture: sensory activation for oral interest

Length of nipple: influences risk of gag response activation





Ziegler, 2020
Zimmerman, 2017

30

Intervention: Secretion Management

Use of pacifier has been shown to:

- Facilitation UES relaxation in swallowing
- Elicit primary peristalsis by decreases excitation in the UES/LES via the vagus nerve

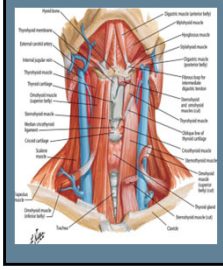
Addition of tastes (sweet tastes):

- Activates primary peristalsis rhythm with improved coordination of breathing for bolus clearance
- Use of small amounts of fluid (dips of pacifier) to reduce risk of aspiration

Shubert 2016
Shah 2020

31

Assessment: Pharyngeal Phase of Feeding



- Aerodigestive development
- Laryngeal Chemoreflex vs cough
- Laryngeal elevation with tracheostomy securement device
- Oral feeding experience
- PEEP pressure on vent (if applicable)
- Cuff size, inflation/deflation, pressure of cuff on esophagus
- Controlled bolus size to reduce risk of laryngeal injury

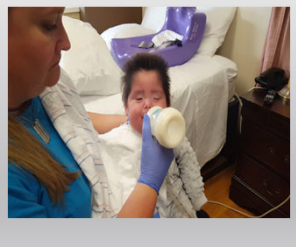
32

Intervention: Pharyngeal Phase

Alignment
- Cranium/cervical spine alignment
- Slight chin tuck
- Neutral trunk with posterior pelvic tilt

Position of infant
- Supported upright
- Right sidelying
- Left sidelying

Swallow Activation
- Flow Rate
- Viscosity
- Temperature of fluid



33

Intervention: Bottle Selection: Sensory and Motor Considerations

Shape: Consider intrinsic tongue activation

Narrow vs wide base consider vertical gap, mandibular movement, tongue extrinsic control

Flow rate: consider slowest flow, discrepancy between oral and pharyngeal phase skills

Integrity of nipple: sensory skill

Vented system: reduce aerophagia

34

Monitoring for Aerophagia

Vented bottle system to reduce risk of aerophagia

Slowest flow nipple with consideration for silicone integrity due to poor oral sensory skills and palate shape

Allow for gastric decompression by venting g-tube (if possible)

Frequent burping during feeding

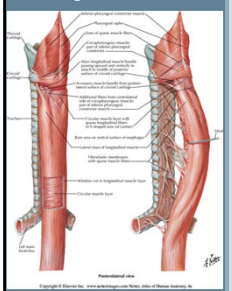
Auditory assessment
- Hard swallows, gulping

Cervical Auscultation
- "Clink and Clunk"

Frakking 2019
Menzen 2020

35

Assessment: Esophageal Phase of Feeding



Consideration of in-dwelling tube (OG, NG, NJ, OJ)

UES tonic relaxation for bolus descent

Esophageal propulsion development, force, and speed

TRLES: Tonic Relaxation of Lower Esophageal Sphincter

36

Intervention: Esophageal Phase

NNS prior to feeding to facilitate UES activation

Spinal flexion and extension (gentle) during burping to alter pressure gradient of LES

Supported upright during feeding to allow gravitational assistance with bolus propulsion

Bolus sizing with slowest flow nipple

Bolus consolidation with altered viscosity

Upright positioning after oral feeding to reduce ascending pressure into LES

Gastric decompression during oral feeding: continual or intermittent

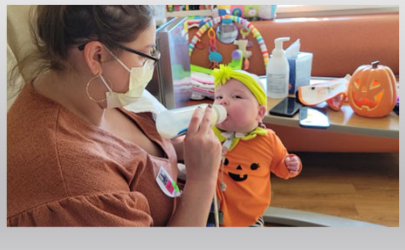
Protection from ascending refluxate
- Increase rate of feeding
- J-feedings
- Ferrell bag
- Continuous drip feeding at night (protect sleep)

37

Case Examples

38

Imagine the Possibilities…….



39

Arianna

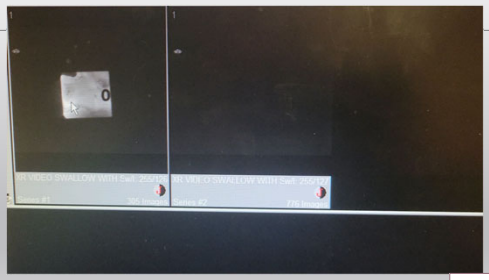
- Position: Supported upright
- Feeding Device: vented bottle, slowest flow, standard shape
- Supports: cervical elongation, mandibular support, pacing, controlled flow

40

Early Feeding Skill Development

41

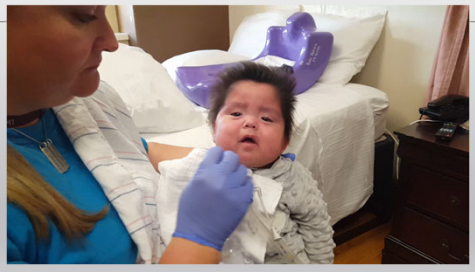
Video Fluoroscopy Swallow Study



McGrattan 2020

42

Eva: Oral motor prep

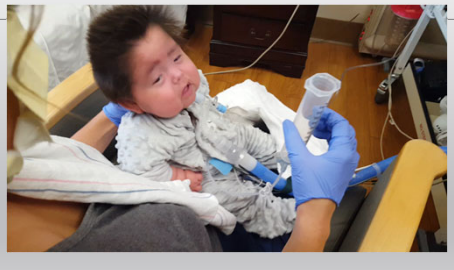


43

Eva: Initial Feeding, progressive lingual input

44

Gastric Decompression: Subglottic breathing with swallow



45

When it all comes together: Postural Control and Oral Feeding

46

Breastfeeding

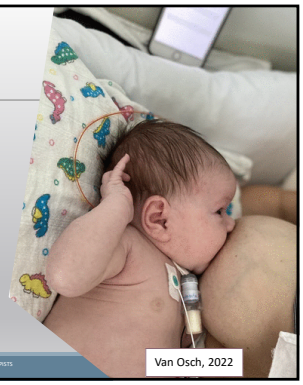
Position of infant and mother
- Sidelying (cross cradle) with vent tubing on unweighted infant side, dependent loop to reduce risk of lavage

Flow rate: partial pump, full pump, full breast

Trach cuff inflation/deflation
- Deflated is preferred

Pulmonary equipment to reduce occlusion of tracheostomy tube or exhalation valve
- HME (heat moisture exchange unit)
- Vent tubing exhalation valve
- Flextend trach

Infant oral skills, latch, use of nipple shield



Van Osch, 2022

47

Additional considerations for oral feeding development

Progressive tolerance of tracheostomy tube cuff deflation

Consideration of One-Way Valve to restore subglottic pressure

Advancing infant to solids

48

Summary

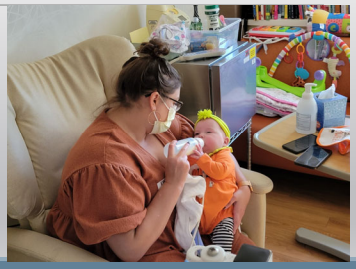
- According to American Academy of Pediatrics the incidence of infants requiring tracheostomy tubes is increasing with the PRIMARY medical reason due to Infants requiring prolonged positive pressure due to PULMONARY pathology
- Placement of a tracheostomy tube in infants reduces laryngeal elevation, subglottic pressure, oral sensation, secretion management, taste, smell, and upper airflow. All of which contribute to poor oral feeding skill development.
- Clinicians assess and integrate the following information when creating oral feeding plans for infants with tracheostomy tubes: Oral Phase: oral sensory deprivation and lingual skills; Pharyngeal Phase: risk of aspiration/penetration as related to anatomical changes and influence of tracheostomy cuff on swallow: Esophageal Phase: prolonged esophageal dysmotility due to dependence on alternate feeding tube
- Creating an oral feeding guideline establishes consistency of care to advance oral feeding developmental for infants with tracheostomy tubes

49

When Feeding Transitions to Eating…….

Thank you for your attendance today!

Contact: Holly Schifsky, OTR/L, CNT, NTMTC, CBIS
hschifs1@fairview.org



50

References

Akangire, G., Taylor, J. B., McAnany, S., Noel-MacDonnell, J., Lachica, C., Sampath, V., & Manimtim, W. (2021). Respiratory, growth, and survival outcomes of infants with tracheostomy and ventilator dependence. *Pediatric research*, *90*(2), 381-389.

Brooks, L., Figueroa, J., Edwards, T., Reeder, W., McBrayer, S., & Landry, A. (2020). Passy muir valve tolerance in medically complex infants and children: Are there predictors for success?. *The Laryngoscope*, *130*(11), E632-E639.

Fuller, C., Wineland, A. M., & Richter, G. T. (2021). Update on pediatric tracheostomy: Indications, technique, education, and decannulation. *Current Otorhinolaryngology Reports*, *9*(2), 188-199.

Goday, P. S., Huh, S. Y., Silverman, A., Lukens, C. T., Dodrill, P., Cohen, S. S., ... & Phalen, J. A. (2019). Pediatric feeding disorder: consensus definition and conceptual framework. *Journal of pediatric gastroenterology and nutrition*, *68*(1), 124.

Hansmann, G., Sallmon, H., Roehr, C. C., Kourembanas, S., Austin, E. D., & Koestenberger, M. (2021). Pulmonary hypertension in bronchopulmonary dysplasia. *Pediatric Research*, *89*(3), 446-455.

Henningfeld, J., Lang, C., Erato, G., Silverman, A. H., & Goday, P. S. (2021). Feeding disorders in children with tracheostomy tubes. *Nutrition in Clinical Practice*, *36*(3), 689-695.

51

References

Jefferson, N. D., Cohen, A. P., & Rutter, M. J. (2016, June). Subglottic stenosis. In *Seminars in pediatric surgery* (Vol. 25, No. 3, pp. 138-143). WB Saunders.

Koo, J. K., Narvasa, A., Bode, L., & Kim, J. H. (2019). Through thick and thin: the in vitro effects of thickeners on infant feed viscosity. *Journal of Pediatric Gastroenterology and Nutrition*, *69*(5), e122-e128.

Mercuri, E., Pera, M. C., & Brogna, C. (2019). Neonatal hypotonia and neuromuscular conditions. *Handbook of clinical neurology*, *162*, 435-448.

McGrattan, K. E., McGhee, H. C., McKelvey, K. L., Clemmens, C. S., Hill, E. G., DeToma, A., ... & Martin-Harris, B. (2020). Capturing infant swallow impairment on videofluoroscopy: timing matters. *Pediatric radiology*, *50*(2), 199-206.

Pullens, B., & Streppel, M. (2021, June). Swallowing problems in children with a tracheostomy. In *Seminars in Pediatric Surgery* (Vol. 30, No. 3, p. 151053). WB Saunders.

Praud, J. P. (2020). Long-term non-invasive ventilation in children: current use, indications, and contraindications. *Frontiers in pediatrics*, *8*, 584334.

Schweiger, C., & Manica, D. (2021, June). Acute laryngeal lesions following endotracheal intubation: Risk factors, classification and treatment. In *Seminars in Pediatric Surgery* (Vol. 30, No. 3, p. 151052). WB Saunders.

Shah, H., & Jadcherla, S. R. (2020). Secretion Management in Tracheostomized Infants using Unconventional Approaches and Outcomes: A Case Series. *American Journal of Perinatology*, *37*(13), 1335-1339.

Shubert, T. R., Sitaram, S., & Jadcherla, S. R. (2016). Effects of pacifier and taste on swallowing, esophageal motility, transit, and respiratory rhythm in human neonates. *Neurogastroenterology & Motility*, *28*(4), 532-542.

52

References

Sobotka, S. A., Laudon, S., Jackson, A. J., Harendt, S. E., & Baker, C. D. (2022). A Literature Review of Feeding Disorders in Children with Tracheostomies and Ventilators. *Pediatric Annals*, *51*(7), e291-e296.

Sun, J., & Li, Y. (2022). Long-term, low-dose macrolide antibiotic treatment in pediatric chronic airway diseases. *Pediatric Research*, *91*(5), 1036-1042.

Van Osch, K., Hunter, K., & Graham, M. E. (2022). Supporting Direct Breastfeeding in a Tracheostomy-Dependent Neonate: A Case Report. *Annals of Otology, Rhinology & Laryngology*, *131*(4), 445-449.

Wiechers, C., Thjen, T., Koos, B., Reinert, S., & Poets, C. F. (2021). Treatment of infants with craniofacial malformations. *Archives of Disease in Childhood-Fetal and Neonatal Edition*, *106*(1), 104-109.461-468.

Ziegler, A., Maron, J. L., Barlow, S. M., & Davis, J. M. (2020). Effect of Pacifier Design on Nonnutritive Suck Maturation and Weight Gain in Preterm Infants: A Pilot Study. *Current Therapeutic Research*, *93*, 100617.

Zimmerman, E., Forlano, J., & Gouldstone, A. (2017). Not all pacifiers are created equal: a mechanical examination of pacifiers and their influence on suck patterning. *American Journal of Speech-Language Pathology*, *26*(4), 1202-1212.

53