

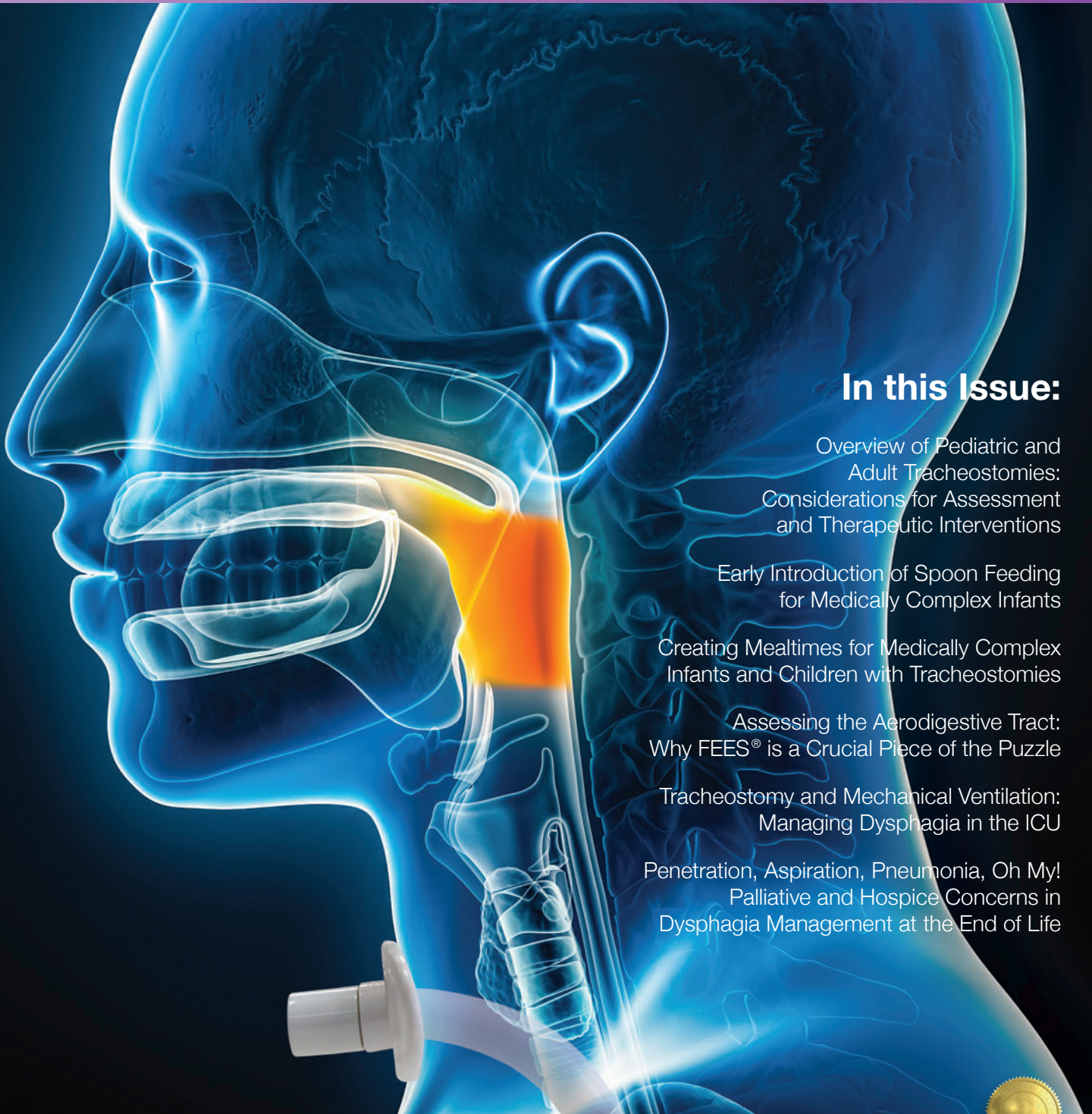


P A S S Y M U I R ' S

AERODIGESTIVE HEALTH

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Creating Mealtimes for Medically Complex Infants and Children with Tracheostomies

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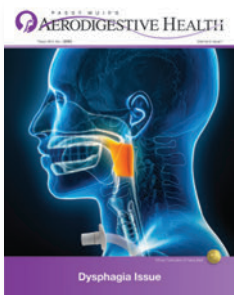
Tracheostomy and Mechanical Ventilation: Managing Dysphagia in the ICU

Penetration, Aspiration, Pneumonia, Oh My! Palliative and Hospice Concerns in Dysphagia Management at the End of Life

Official Publication of Passy Muir



Dysphagia Issue



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ARTICLES LEGEND



Dysphagia FEES Pediatric Trach

Welcome to Passy-Muir, Inc.'s *Aerodigestive Health*: Dysphagia Considerations for Pediatric and Adult Patients

Welcome to this issue of *Aerodigestive Health*. The focus of this publication is to provide education and clinically relevant information for the safe and efficacious use of the Passy Muir® Tracheostomy & Ventilator Swallowing and Speaking Valve (PMV®) and to provide clinically relevant information for working with patients. Each edition of *Aerodigestive Health* provides articles and other resources on the care of adult and pediatric patients with a focus on those who are tracheostomized, with or without mechanical ventilation. It is the Editor's objective that *Aerodigestive Health* provide readers with clinical perspectives and cutting-edge research to address specific questions raised by practitioners relating to the care of patients.

In this edition, you will find these key elements:

- Editor's commentary – An overview of the publication topic.
- Healthcare practitioners' perspectives – Articles by healthcare professionals on clinical issues.
- Abstracts for peer-reviewed, published research studies – Top studies with summaries of each featured article.
- Research bibliography – A bibliography of recent research related to the issue's theme.
- Clinical take-home boxes – Relevant clinical information for healthcare practitioners, including protocols.

For this issue, the primary focus is ***Dysphagia Considerations for Pediatric and Adult Patients***, providing a unique overview of assessment and treatment considerations for both the pediatric and adult patient populations. The number of neonatal, pediatric, and adult patients with tracheostomies is growing each year secondary to advancements in medical care and interventions to sustain life. Pullens and Streppel (2021) discussed the importance of restoring normal airway physiology to assist with feeding and swallowing, which would include restored pressure. If a patient has a tracheostomy tube or is on mechanical ventilation, the normal processes for pressure regulation and swallowing are disrupted by the change in airflow.

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Financial Disclosure

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Working with patients with tracheostomy and mechanical ventilation, questions often arise regarding treatment interventions and how to determine best practices. With this medically complex patient population, determining appropriateness for intervention and the type of interventions to be provided can be daunting, especially when considering dysphagia, regardless of age. The first step is understanding what is occurring due to the tracheostomy, mechanical ventilation, and diagnoses.

When a patient receives a tracheostomy, an incision (either surgical or percutaneous) is made to place a tracheostomy in situ. With the placement of a tracheostomy tube, several immediate effects occur. The tracheostomy tube is a means for the patient to inhale and exhale through the tube to provide improved respiratory function and support. However, placement of the tube leads to other changes. An open tracheostomy tube changes the direction of airflow, with airflow now being in and out through the tube and bypassing the mouth and nose (when the cuff is inflated). This change in directional airflow negatively affects smell and taste, voicing, swallow function, subglottic pressure, lung recruitment, positive airway pressure, secretion management, cough effectiveness, and more. One of the more impactful changes is the loss of the pressurized system that is the human body. With an open tracheostomy tube, pressure regulation and the use of pressure for functions such as trunk support and postural control may be impaired.

When considering a treatment plan for a patient with a tracheostomy, the first step is to restore the more normal closed system and to restore the ability to regulate pressure. A primary means for closing the system is to use the Passy Muir Tracheostomy & Ventilator Swallowing and Speaking Valve, a bias-closed position, no-leak valve. Using the Valve allows a patient to breathe in through the tracheostomy tube but out through the upper airway (mouth and nose). The Valve works by closing at the end of inspiration, which redirects airflow upwards through the vocal folds and upper airway. Research has shown that this redirection of airflow assists with improving secretion management, increasing sensory awareness, improving swallowing, improving communication, restoring the pressurized system, and restoring natural physiologic PEEP (positive end expiratory pressure), among other benefits.

This issue of *Aerodigestive Health* brings together perspectives that present considerations for feeding and swallowing treatment interventions. These interventions touch on both how to use the Valve and what therapies to consider. When considering therapies, if the patient has a Passy Muir Valve and more normal physiologic function has been restored by closing the system, then the therapeutic options are the same as with a patient who does not have a tracheostomy. The primary consideration is that once the system is restored to a more normal pressurized system, then the therapy considerations revert to standard practices for the identified issues. What this means is that once the system is closed, if the patient has poor feeding and swallowing skills, then initiating therapies that address feeding and swallowing would be appropriate. If a patient demonstrates dysphagia, then assessment and treatments will generally follow traditional practice guidelines with considerations for the tracheostomy. In this issue, the authors share either therapeutic interventions regardless of tracheostomy presence or specifically address modifications that may be necessary with a tracheostomy.

We begin with articles addressing the pediatric population. From a discussion on addressing early spoon feeding to how to create mealtimes for improved feeding and swallowing, these articles present approaches for pediatric patients. For the adult population, the articles address swallowing intervention in the ICU, use of FEES with patients with tracheostomies, and then progress to a discussion on end-of-life considerations.

The primary take-away from this issue is that the earlier we provide treatment interventions with these medically complex patient populations, the sooner the many benefits begin, both for the patient and their recovery.

Justin A King PhD, CCC-SLP

About the Editor

Kristin King, PhD, CCC-SLP has been a speech-language pathologist in a variety of settings since 1995. She earned her PhD in Communication Sciences and Disorders from East Carolina University in 2008. Her expertise is in cognitive-communication and swallowing disorders with medically complex patients of all ages, particularly those with needs secondary to traumatic brain injury (TBI), tracheostomy/ventilator, and pre-term birth. Dr. King has published several peer-reviewed articles regarding evaluation and treatment of TBI, and she speaks to both domestic and international audiences regularly on the use of speaking valves, evaluation and treatment following TBI, and swallowing disorders. She is the co-editor of the 2023 book, *Tracheostomy and Ventilator Dependence in Adults and Children*.



Upcoming Issues:

If you have an interest in submitting or writing for one of our upcoming issues, please contact me at aerodigest@passymuir.com.



Overview of Pediatric and Adult Tracheostomies: Considerations for Assessment and Therapeutic Interventions

Kristin A. King, PhD, CCC-SLP

Occurrence of Tracheostomies

The occurrence of tracheostomies in the neonatal, pediatric, and adult patient populations increases secondary to advancements in medical care and interventions to sustain life. While Watters (2017) reported that tracheostomies are less commonly performed in pediatrics as compared to the adult patient population, with tracheostomies occurring in < 3% of pediatric patients, the impact of a tracheostomy is significant for all. The number may be lower for the pediatric population compared to the adult, but tracheostomies are increasingly occurring in children due to the chronic nature of various complex conditions, such as abnormal ventilatory drive, heart disease, lung disease, neurologic impairment, and irreversible neuromuscular conditions (Watters, 2017). This change in the needs for pediatric patients has led to more than 50% of the patients being under the age of 1 year at the time of tracheostomy placement.

When considering the number of adult patients with tracheostomies, the incidence has grown in recent years due to the occurrence of the COVID pandemic. In a study conducted in 2008, it was estimated that by the year 2020, there would be over 600,000 adult patients requiring prolonged mechanical ventilation (Zilberberg & Shorr, 2008). But little did the authors know that, in 2020, a pandemic would change the face of medical care. It was estimated that in 2020, 965,000 people would require mechanical ventilation due to COVID-19, not including other disease and injury processes (Halpern & Tan, 2020). Just considering COVID-19 patients, the potential incidence of tracheostomies is much higher than the prediction given in 2008.

Impact of a Tracheostomy on Swallowing Functions

With tracheostomies, changes in the aerodigestive system become evident through impacts on voice, swallowing, cough, and other functions. The prevalence for these aerodigestive challenges, which may lead to feeding and swallowing difficulties, is high.

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The placement of a tracheostomy tube and prolonged mechanical ventilation with an inflated cuff causes a disconnect between the upper and lower airway. The lack of airflow through the upper airway can often lead to multiple negative changes affecting speech and swallowing: reduced subglottic pressure; decreased sensation to the pharynx and glottis; reduced laryngopharyngeal reflex; decreased ability to manage secretions, requiring more frequent suctioning; decreased sense of taste and smell; inability to vocalize; increased aspiration risk; and muscle disuse and atrophy. A disconnect between respiration and swallowing also may negatively impact the ability to coordinate breathing and swallowing. For pediatrics, long term tracheostomy placement also has been associated with delayed acquisition of language, delayed social development, and risk of impaired parent-child bonding.

Henningfeld et al. (2019) addressed the physiologic effects of a tracheostomy on feeding and swallowing, including some considerations for gross motor function and development. The authors hypothesized that the children would exhibit delays secondary to the tracheostomy (Henningfeld et al., 2019). They found that growth delays, G-tube (gastrostomy tube) feedings, and feeding skill delays were attributed to the tracheostomy. They also reported that ventilator-dependence, cuffed tracheostomy, and in-line speaking valve use were infrequently associated with the feeding and swallowing evaluation (Henningfeld et al., 2019). Pullens and Streppel (2021) discussed the importance of restoring normal airway physiology in the pediatric population to assist with feeding and swallowing, which would include restoring pressure by using a speaking valve.

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The adult population also has several studies which indicate the need to restore subglottic pressure to assist with improved laryngeal function, swallowing, cough, and secretion management (Alhashemi et al., 2022). It has been reported that dysphagia occurs in 11% to 93% of patients following tracheostomy (Skoretz et al., 2020). While a tracheostomy provides benefits for respiratory function, its insertion point has an anatomical location that is within a shared pathway for respiratory and alimentary systems. Physiologic and biomechanical changes to the swallow may occur due to the disruption of the upper airway by the tracheostomy tube (Skoretz et al., 2020b).

Closing the System to Restore Physiology

A primary means for closing the system to restore more normal physiology and pressures for patients with tracheostomies is the use of a bias-closed position, no-leak Valve. When a patient has a tracheostomy, airflow is directed in and out through the tracheostomy tube and bypasses the upper airway. The PMV[®] works by closing at the end of inspiration, which redirects 100% of airflow upwards through the vocal cords and upper airway. Research has shown that this redirection of airflow assists with improving secretion management, increasing sensory awareness, improving swallowing, and restoring natural physiologic PEEP (positive end-expiratory pressure), among other benefits (O'Connor et al., 2019).

Normalizing Function

Assessment and usage of a Passy Muir Valve is important for the normalization of functions for all patients and for development in children. The primary consideration during assessment is that the patient has a patent airway, meaning the patient can exhale around the tracheostomy tube and out the mouth and nose. Having a qualified team familiar with airway management is a key component for successful Valve use. The participation of infants, toddlers, and young children in the assessment process may be more difficult than with adults because of their limited ability to follow commands and volitionally vocalize; therefore, additional methods, such as transtracheal pressure (TTP) measurements, may be used to assess airway patency (Brooks, 2019). TTP is a method for measuring the pressure in the airway with the tracheostomy tube in place. It can be used with finger occlusion or a speaking valve to determine airway patency. TTP has been found to be a predictor associated with successful use of the Passy Muir Valve.

While speech and language development is an important consideration in pediatrics, research from the adult population suggests significant benefits for improved secretion management, cough function, and swallowing, all of which are influenced by pressure (O'Connor et al., 2019). Research has shown that subglottic pressure is reduced with a tracheostomy, negatively impacting feeding and swallowing, cough, and secretion management (Eibling & Gross, 1996). Pullens and Streppel (2021) discussed the importance of restoring normal airway physiology to assist with feeding and swallowing, which would include restored pressure, by using a speaking valve in the pediatric population. The adult population also has several studies which indicate the need to restore subglottic pressure to assist with improved laryngeal function, swallowing, cough, and secretion management.

Whitmore et al. (2020) also reported that the use of speaking valves for patients with and without mechanical ventilation was strongly supported among the reviewed literature to promote speech and communication, which had an additional impact on patient satisfaction, and to contribute to alveolar recruitment, weaning, and quality of life. One barrier identified to using measurement tools with patients for assessing pain, cognitive status, and other areas while in the ICU is the ability of the patient to participate verbally. Zaga et al. (2022) identified that the use of a one-way Valve in-line with mechanical ventilation would assist with increasing the relevance of some measures.

Conclusion

Understanding the impact of a tracheostomy for both the pediatric and adult patient populations plays a significant role in the ability to plan assessments and to provide appropriate therapeutic interventions. However, knowing that a Passy Muir Valve restores more normal physiology, and investigations have shown that use of the Valve and restoring a closed system have benefits for the patient, supports the idea of using a Valve in combination with traditional therapies. It is important to remember that the Valve closes the system and restores airflow to the upper airway. Once this more normal physiology is restored, then assessment and therapeutic interventions are primarily the same as what would be done with a patient without a tracheostomy. When addressing dysphagia management, these same points are considered.

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PMV® 2001 (Purple Color™) on pediatric tracheostomy tube

Early Introduction of Spoon Feeding for Medically Complex Infants

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Pediatric feeding disorders are becoming increasingly common amongst children; recent trends indicate increased prevalence of feeding difficulties in children under 5 years of age (Alhashemi et al., 2013; Kovacic et al., 2021). This is likely in part due to increased awareness of the signs of pediatric feeding disorders, as well as improved medical outcomes for the premature and medically complex population (Rosen, 2021). While the prevalence of feeding disorders in typically developing infants and toddlers is increasing, when their development is compounded by complex medical diagnoses, the development of skills to support oral feeding may be even more challenging. For example, in an infant or toddler with a tracheostomy, not only do you have the feeding and swallowing changes to manage, you also are looking at a compromised respiratory system that contributes to the question of safety.

Failure to thrive, aversive feeding difficulties, oral sensory deficits, oropharyngeal dysphagia – often, one or more of these terms and diagnoses are used to describe children experiencing pediatric feeding disorders. When feeding difficulties are identified in the early stages of development, medical teams and rehabilitation therapists aim to foster the development of oral feeding skills to support adequate nutritional intake and reduce reliance on supplemental means of nutrition. Addressing these needs should occur regardless of the diagnosis and medical complexities. When feeding difficulties persist beyond the NICU, ongoing feeding services are warranted to work towards successful oral feeding, including introduction of “next steps” toward developmentally appropriate feeding methods and textures. For children with severe feeding difficulties and significant medical comorbidities (e.g. tracheostomy), when breast and bottle feeding are not successful, introduction of spoon feeding may be a bridge to oral feeding success.

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Meeting Nutritional and Hydration Needs

Helping a medically complex infant meet their nutrition and hydration needs by full oral diet is frequently complicated. Swallowing is a highly dynamic, interrelated process relying on the synchrony of 26 muscles of the mouth and throat and the relative stability of each subsystem (e.g., neurological, respiratory, cardiovascular) to coordinate safely (Lau, 2015). When an infant has an impaired subsystem, it can disrupt their ability to regulate their state or breathing, and to coordinate movements like sucking and swallowing. Additionally, if an infant has chronic difficulty feeding safely, feeding orally may result in medical setbacks, prolonged hospital admissions, and long-term feeding difficulties.

For medically complex infants, feeding services may be provided in a variety of settings. These settings include in the home with a feeding therapist as provided through home care or early intervention, or in a subacute facility to continue working towards feeding goals. These babies are often discharged from the NICU with supplemental nutritional support that may include the use of nasogastric tubes, gastrostomy tubes, or central lines. During these transitional times, parent and caregiver often have goals of improving oral feeding skills in order to reduce reliance on supplemental nutrition.

Lack of Experience

While infants are born with a reflex to suck and drink, premature infants may be too young or sick in the first few weeks or months of their life to be offered opportunities to practice these skills. This lack of experience can impact the development of essential oral-motor skills that aid in self-regulation and suck, swallow, and breathe coordination for eating safely and efficiently (Poore et al., 2008; Zimmerman & Barlow, 2009). For example, intubated infants or infants on high respiratory support may be restricted from oral feeding because they are at risk for aspiration, or they cannot remain stable while engaging in sucking or bottle feeding (Ferrara et al., 2017). Further, medically fragile babies in the NICU are often exposed to noxious stimulation to their face and mouth (e.g., medical tape for nasogastric tubes) to keep them stable and healthy. While medically necessary, the equipment may be a significant source of stress that reduces interest in accepting the pacifier to soothe. Studies indicate that giving infants in the NICU opportunities to suck on a pacifier

to calm, without the added burden of coordinating swallowing and breathing, can be beneficial to preserving an infant's sucking reflex (Zimmerman & Barlow, 2009). This intervention may be important to preserving oral motor skills until the baby is medically ready to start oral feedings.

Role of the Speech-Language Pathologist

When infants have intact pharyngeal swallows and have maintained their suck reflex, it is important to optimize that skill and attempt to reduce the possibility of negative behaviors during feeding. Improvement in an infant's participation in feeding and aiding the preservation of their suck response may be done by using cue-based feeding methods, positioning changes, changes in nipple flow rate, and changes in viscosity of liquid (Thoyre et al., 2013). Cue based feeding, also known as infant driven feeding, is a process of closely attending to the babies' hunger cues, and responding to signs of disengagement or stress during feedings (Ross, 2008; Shaker, 2013). These signs can be subtle, including behaviors like absent or delayed rooting, inability to maintain an alert state for feeding, producing a weak suck or pulling off the nipple. Ongoing collaboration with the medical team and nutritional team is often warranted to monitor and address feeding difficulties related to medical comorbidities. For example, in the instance of ongoing gastrointestinal discomfort, it would take a team assessment to consider all the contributing factors. The "critical period" of oral-motor development occurs between birth and 2-4 months corrected age, before a babies' reflex to suck changes to a volitional skill. If infants are unable to establish adequate sucking skills during this time, transitioning a baby to bottle feeding may be more difficult to achieve. As an SLP working in a subacute rehabilitation facility, one of the main goals for therapy is often the introduction and optimization of feeding by mouth for medically complex infants. As part of the medical team working towards oral feeding goals, it warrants the questions, "What can we do if the patient's reflexive sucking has stopped? Can we help them re-learn to suck? How can we set this child up for feeding success in their future?"

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When to Consider New Feeding Skills

In this patient population, a solution becomes difficult to identify. There is no reliable method to “teach” a baby who is no longer engaging in latching or sucking to breast or bottle. Interventions may include optimizing comfort, improving state regulation, and offering oral stimulation only when the infant is showing interest in oral stimulation. However, when bottle feeding is contraindicated due to dysphagia or severe oral aversion, it can be beneficial to advance to development of a new feeding skill. Early introduction of spoon feeding and straw drinking is a useful tool to promote acceptance of feeding for these populations.

Spoon trials eliminate the demand for a sequential suck-swallow-breathe pattern...

Introduction of baby food via spoon is generally recommended between 4-6 months of age; however, in some instances, it can be provided sooner in order to provide positive oral experiences. Spoon trials eliminate the demand for a sequential suck-swallow-breathe pattern, thus babies with pharyngeal dysphagia may benefit from the presentation of isolated bites and sips to allow ample time to coordinate their airway protection prior to the next bite. As it is less physically demanding, it allows therapists and caregivers to pace the feeding however necessary to allow the baby more time to complete anterior-posterior transit of the bolus and coordinate the swallow. Additionally, for babies who demonstrate a severe oral aversion, introduction of feedings via spoon provide a novel sensory experience that does not elicit the heightened stress response that nipple or pacifier presentations induce. Moreover, it may desensitize the baby to oral stimulation and prime them for readiness for the next developmental feeding steps. However, it is imperative to their feeding development that cue-based methods and ideology are maintained, such as consistent and ongoing monitoring of responses and interest, modification of bite size to promote acceptance and discontinuation of spoon trials with negative reactions. One consideration for appropriate initiation of spoon trials is positioning, given that the infant must be able to be positioned semi-upright in a high chair or tumbleform chair with external support as necessary to ensure midline positioning and adequate trunk support.

Introducing the Spoon and Small Bites

Introduction of this experience typically begins with an empty spoon. Once an infant is demonstrating tolerance of an empty spoon in their mouth and is demonstrating the ability to sit upright in a highchair with supports, it may be time to consider initiation of small taste presentations. This is completed through a slow introduction, first by providing very small tastes of a familiar item (e.g., breast milk or formula). If the baby is accepting of small tastes and can complete transfer of the liquid and swallow without coughing, choking, or oxygen desaturation, bolus size can be slowly increased over the course of therapy as tolerated. Further introducing texture through the addition of rice cereal or oatmeal in formula can provide more tactile input to the infant’s mouth and increase the time that the baby can learn to move the liquid, allowing for more awareness, and control of the bolus. Positive outcomes following early initiation of spoon feeding may include improved behavioral responses to feeding, improved lip closure to spoon, and emergence of early tongue depression and lateralization to collect liquid. As the baby develops, these skills can then be transferred to assisted straw drinking after 6-8 months corrected age.

Transitioning to Assisted Straw Drinking

Assisted straw drinking through presentation of liquids via a straw-based squeeze bottle (e.g., honey bear squirt bottle) can be a significant step towards gaining independence from supplemental feeds. Using a straw bottle has also been found as beneficial for patients who have severe negative reactions to bottle attempts, commonly referred to as behavioral refusal. Behavioral refusal manifests due to history of negative feeding experiences, likely due to stress with early attempts to orally feed in the setting of medical issues. Frequently, these infants have improved medically and are physically able to drink from a bottle. They are able to demonstrate skills like sucking on a pacifier, but refuse to drink from a bottle nonetheless. The novel sensory experience of a straw verses nipple and the ability to provide paced, single sips can create an environment of success. Once acceptance is established, lip closure around the straw, independent sipping and sequential sips may then be targeted in therapy. When continued acceptance is observed through cue-based feeding methods, tube weaning may become a targeted goal. While the burden of feeding will remain on the caregiver via squeezing until mouth closure and independent sipping is achieved, the ability to reduce reliance on enteral feeds dependence becomes possible at this point.

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Multidisciplinary Support

Multidisciplinary support for the family throughout this process is critical. Often, infants with complex medical diagnoses and history require supplemental nutrition and hydration for prolonged periods of time, which may be highly stressful for families to manage and handle. These methods for early introduction of spoon and straw drinking are intended to promote positive feeding experiences for both the baby and caregiver. It can have the additional benefit of reducing the length of tube feeding reliance with the ultimate goal of weaning supplemental feeds and establishing a full diet by mouth. Of course, ongoing use of responsive feeding techniques and monitoring of signs and symptoms of airway protection impairments with the introduction of each new step is essential to ensure patient safety, comfort, and ultimately their long-term feeding success.

Family training and participation is also an integral step...

Responsive feeding, similar to cue based feeding, includes following the patient's lead by attending to their nonverbal communication closely; things like leaning into the spoon/straw to request sips or bites and keeping visual focus to the feeding task can tell caregivers if the baby wants to continue or not. Responding to these cues consistently provides our little patients autonomy and trust in the feeding experience. Family training and participation is also an integral step in this process to ensure carryover of skills learned and empower families who have a child experiencing a pediatric feeding disorder. To achieve this, it is crucial that a multidisciplinary approach is maintained throughout the child's development for ongoing monitoring of adequate airway protection, behavioral responses and efficacy of medical interventions. In summary, the early introduction of spoon and straw drinking can be useful therapeutic interventions for infants who are unable to transition to breast or bottle feedings and can lead to achievement of long-term feeding goals.



Spoon feeding during therapy while using a Valve in-line with mechanical ventilation.

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Creating Mealtimes for Medically Complex Infants and Children with Tracheostomies

Stephanie Waters, MS, CCC-SLP, CLC, TSSLD

As medical interventions progress for our youngest and most medically complex patients, the use of the Passy Muir® Valve (PMV®) in the infant and pediatric population is vital for improving developmental outcomes in terms of speech and language, as well as feeding and swallowing. As stated by Woodnorth (2002), “children with tracheostomies constitute a diverse population from many standpoints, including underlying medical diagnoses, health issues, developmental status and communication needs.” The placement of a tracheostomy may be vital for this population; however, the impact that a tracheostomy can have on developmental outcomes must be acknowledged. Speech-language pathologists who work with this population often target improving wear time of speaking valves which in turn creates goals for speaking valve use to facilitate verbal speech as well as improving secretion management and swallow function.

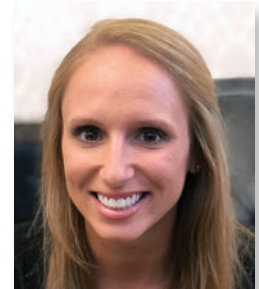
According to Jackson et al. (2018), speech-language pathologists apply their understanding of the upper aerodigestive tract with respect to the development of the aerodigestive and neurological systems in medically complex children with tracheostomy. Successful assessment and initiation of Passy Muir Valve use is best with an interdisciplinary team collaboration including the child’s pediatrician, otolaryngologist, pulmonologist, and respiratory therapist. To improve functional outcomes in terms of developmental milestones, best practice also includes collaboration with additional members of the child’s medical team, family, occupational therapist, physical therapist, and psychologist.

Tracheostomy Placement and Feeding Considerations

Joan Arvedson (2000) indicated that infants and young children with long-term tracheostomy, with or without the need for ventilator assistance, often have feeding and swallowing difficulties due to the initial underlying reason for the placement of the tracheostomy as well as postoperative changes in physiology and anatomy. Children with tracheostomies are at risk for oropharyngeal dysphagia due to a history of preterm birth, cardiac defects,

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gastrointestinal disorders, and neurological disorders (Dodrill & Gosa, 2015). It is known that the presence of a tracheostomy results in reduced supraglottic and subglottic pressure needed to generate a functional pharyngeal swallow. Changes to this positive internal pressure results in risk for pharyngeal dysphagia and subsequent higher risk for aspiration (Arvedson, 2000). With this known risk and the benefits reported with PMV use for restoring positive airway pressure to the system and upper airway sensation, the use of the Passy Muir Valve is crucial for the medically complex pediatric patient with a tracheostomy.

Infants requiring tracheostomy placement are at a higher risk for feeding deficits due to delay in oral stimulation that promotes the development of crucial feeding and swallowing skills during the first year of life. Due to medical complexity, these infants often miss critical windows of feeding skill development resulting in oral dysphagia as well as oral aversions, creating a multifaceted feeding disorder. Infants and children requiring tracheostomies typically require longer hospitalization periods with need for enteral feeding support. These patients may have minimal to no opportunities to eat by mouth, and few have experience with typical, motivating mealtimes. It is recommended that children with tracheostomies be provided with pleasurable oral-motor stimulation, if the child is not medically cleared for oral feeds (Arvedson, 2000). Additionally, if the child is deemed appropriate for conservative oral feeding trials, the use of developmentally appropriate approaches and sensory stimulation with close monitoring of cardiorespiratory status is recommended (Arvedson,

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2000). According to Gosa & Dodrill (2015), children with tracheostomy often require a combination of rehabilitative intervention as well as compensatory strategies. Prior to considering initiation of feeding, interdisciplinary collaboration is needed to determine oral feeding appropriateness with attention to risk of aspiration, impact of chronic aspiration on lung health, and overall dysphagia status. Knowing these factors allows for safe sensory exploration related to mealtime and exposure to conservative oral tastes. Maintaining medical stability by monitoring the ‘whole child’ is vital when feeding children with a complex medical history.

Children with tracheostomies appear to have more significant feeding disorders...

Tracheostomy and Severity of Feeding Disorder

Much of the literature related to feeding and swallowing in infants and children with tracheostomy and PMV use is related to oropharyngeal dysphagia and the pharyngeal swallow following implementation of a Valve. According to Henningfeld et al. (2020), children with tracheostomies appear to have more significant feeding disorders in comparison to other children with feeding disorders. Speech-language pathologists and associated professionals working with this population must consider the complete feeding, sensory, and mealtime experiences that may be altered when working with this patient population. The placement of a tracheostomy typically impacts the patient’s pharyngeal swallow as well as resulting in reduced sensory awareness. The impact can include reduced sense of smell with subsequent impact on taste and limited sensation of secretions.

Changes in posture and trunk control have been noted, secondary to tracheostomy placement, which may create inadequate positioning for mealtime. Children requiring tracheostomy also often require extensive hospitalization due to medical complexity which can lead to reduced home experience around mealtime, cooking, and social gatherings. Long-term hospitalization has been found to impact the typical sensory experiences that contribute to the learning of developmental feeding skills (Lehner & Sadler, 2015). Fostering mealtime participation may be functional as these children often experience inconsistent time at home. The presentation of sensory experiences during mealtimes is often what promotes developmental learning and allows children to create functional responses to stimulation.

Mealtimes and Sensory-Based Experiences

According to Morris (2010), mealtimes “create a multiplicity of opportunities to provide a solid foundation upon which the expansion and mastery of feeding skills is based.” Finding creative ways in which infants and children with tracheostomy can safely participate in sensory-based mealtimes and therapeutic experiences is vital for providing safe yet fun and functional opportunities to participate in the mealtime experience. For infants, this includes skin to skin and use of a mother’s clothing at the bedside for stimulation of smell. If medically appropriate, conservative tastes of breastmilk or formula via cotton swab, pacifier dip, or conservative bottle trials also allows for sensory stimulation.

One way this may be fostered in children is through the development of sensory-based feeding therapeutic opportunities. These opportunities may include individual as well as group therapy frameworks for mealtime participation. By utilizing sensory feeding experiences that provide child-led and sensory-enhanced experiences, infants and children with tracheostomy participate in positive oral experiences that may combat the persistently negative experiences that they may have had through consistent suctioning, medication administration, and oral care. According to Sobotka et al. (2022), appropriately timed conservative trials are critical for children with tracheostomy and subsequent need for supplemental respiratory support due to their higher likelihood of oral sensitivity. The research completed by Sobotka et al. (2022) also suggested that despite respiratory vulnerability, this population can safely be offered small volumes during critical windows to support development. Small volumes may be utilized to maintain interest in oral stimulation as a means of nutrition and to reduce the likelihood of long-standing oral aversion. This research also supports the participation of this population in sensory feeding therapy opportunities that may allow for conservative tastes without pressure to consume a volume of food or liquids and without a goal of enteral tube weaning (Sobotka et al., 2022).

To foster safe, sensory-based experiences for mealtime participation, an initial assessment should be completed. This assessment assists with determining the patient’s baseline medical status and determining if participation in feeding opportunities is appropriate given the overall medical picture. Working with the team, the child’s primary medical provider, including

their pulmonologist, weighs in with details related to the medical picture and plan. The role of speech-language pathologists is to determine baseline oral skills, monitor for signs of potential airway protection deficit, and determine potential food-based sensory experiences that will meet the child where they are in their level of participation.

The expertise of occupational therapy, physical therapy, and nutrition should be considered for additional areas that may help make this population's feeding successful, including determining PO progression plans, positioning for optimal trunk support, and adapted utensils to improve sensory exposure. Outside of maintaining nutrition, mealtimes provide an opportunity for sensory exposure, social interaction, and overall familial bonding. Emphasis on creating a positive mealtime rather than volume-driven presentations of oral trials allows for sensory exploration at the pace of the patient with limited to no demand for consumption of PO trials. This exploration includes looking at, touching, smelling, and tasting food items with an emphasis on child-led exploration and internal motivation to drive participation. True sensory exploration should occur without use of behavioral intervention to improve participation. By utilizing the Passy Muir Valve during sensory exploration, smell and taste are improved which allow for overall improved sensory stimulation through a closed aerodigestive system.

Conclusion

Considering the quality-of-life literature, research with adults and children requiring enteral feeding due to medical complexity has indicated that the ability to eat and enjoy food is directly linked to quality of life (Hopkins et al., 2017). Infants and children with tracheostomy are at significantly heightened risk for having both multifaceted feeding disorders as well as swallow dysfunction due to medical complexity. Often these limited experiences result in oropharyngeal dysphagia and reduced oral feeding presentations during early windows of critical sensory and motor development. To improve these outcomes, the initiation of the Passy Muir Valve paired with safe, sensory-based experiences with food during mealtime allows for safe feeding opportunities while providing mealtime experience to improve quality of life through socialization and sensory exploration. Emphasis on sensory exploration related to mealtime allows for mealtime to be a safe, developmentally appropriate experience

despite medical complexity and need for tracheostomy or respiratory support. Consistent participation in mealtimes paired with therapeutic support may lead to improved feeding outcomes, increased associations with mealtime as a whole, and improved future oral acceptance to improve the quality of life for our pediatric population.

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This is an adapted screener used by the Speech-Language Pathology Department at St. Mary's Hospital for Children to determine candidacy for Sensory Feeding Group in partnership with the Occupational Therapy Department and Medical Team. This screener has been adapted and modified to provide a cumulative screening tool for the medically complex pediatric population served at St. Mary's Hospital for Children.



Sensory Feeding Group – ST Screener

Adapted By: Stephanie Waters, MS, CCC-SLP, CLC & Elizabeth Curney, MS, OTR/L

Patient: _____
 Evaluator: _____ DOE: _____

Background History

Pertinent Diagnosis: _____

Current Nutrition Route:
 PO TPN OG NG ND NJT GT GJT JT

Clearance for PO: Yes No Date of medical clearance & by who: _____

Current Diet Order: _____

Current Medicine Regime (relevant to PO feeding):
Current Allergies/Precautions:
Current Mealtime/Tube Feeding Schedule:

Airway:
 Trach PMSV Cap
 Comment: _____

Respiratory Support:
 Nasal cannula Trach collar CPAP (vent) Full ventilatory support
 Comment: _____

Passy Muir Valve/Trach Cap:
 All waking 1:1 supervision Timed trials
 Comment: _____

History of:
 Poor Oral Feeding Reflux
 Failure to Thrive GERD
 Tube Feeding Pneumonia
 Choking, Gagging, Coughing Nissen
 Emesis during eating Need for modified diet
 Aspiration

Previous Swallow Study Assessment:
 Findings: _____
 Recommendations: _____



Profile of the Child: Current PO Feeding Status

• Therapy Course: _____

• Caregiver Report: _____

• Most Recent Food/Liquid Intake: _____

• Utensils Used: _____

• Duration: _____

• Position: _____

• Liquid Types:

○ Taste: _____

○ Temperature: _____

○ Consistency: _____

• Food Types:

○ Texture: _____

○ Temperature: _____

○ Flavors: _____

• Signs of hunger: Yes No Example: _____

• Treatment Modalities used:

Behavioral Sensory manipulation Sensory exposure

Factors Known to Adversely Affect Feeding:

Biological State

Sleep Feeder

Medication Limited Oral Feeding Experience

Tube Feeding Schedule Decreased Motivation

Grazing Feeding Behaviors Significant history of GI disorder

Calorie Dense Food History of choking, gagging, wrenching,

Liquid Intake Need for ketogenic/specialized diet

Before Meal Activities Difficulty with structured tasks

Inconsistent Feeding Schedule

Additional Comments: _____



Feeding Assessment: Observation

Date/Time: _____
 Attention/Awareness to Environment: Y / N
 Attention to Food/Liquid: Y / N
 Attention to Food Interaction: Y / N

Food/Liquid Triaed:

Dissolvable/Meltables _____

Puree _____

Soft Mechanical _____

Hard Mechanical _____

Solid _____ Thin Liquids _____

Hard Munchable _____ Thickened Liquids _____

Utensils:

Infant spoon Bottle

Maroon spoon Sippy cup

Angled spoon Honey bear

Weighted spoon Cup with cover

Standard spoon Nosey cup

Open cup

Seating/Positioning:

Highchair Cube chair Other: _____

Rifton Toddler Chair

Supports Needed Wedge Towel Roll Other: _____

Present Feeding Behaviors

Hesitancy to Interact Teeth Clenching Gagging

Limited Engagement Wipe from mouth Vomiting

Irritability Expel from mouth Retching

Pushing Head Turning Spitting

Swiping Arching Coughing

Lip Pursing Verbal/Nonverbal Refusal Poor Secretion Management

Crying Kicking Pooling/Pocketing

Protesting Throwing



Additional Comments: _____

Feeding Trial Comments:

Summary/Recommendations:

Frequency Order Recommendations

Sensory Feeding Group – 1 month trial

Sensory Feeding Group 1x60min/week (to be reviewed on quarterly basis)

Not a candidate for Sensory Feeding Group at this time

Therapist Name _____ Date _____



Assessing the Aerodigestive Tract: Why FEES® is a Crucial Piece of the Puzzle

Elizabeth Norberg, MS, CCC-SLP

Introduction

The aerodigestive tract is a complex system that transitions the airway into an alimentary tract with the coordination of over 30 muscles, 5 cranial nerves, and 3 peripheral nerves to clear the bolus both safely and efficiently (Shaw & Martino, 2013). Respiratory failure and the need for artificial airway placement can have a significant impact on swallowing and communication functions that adversely affect a patient's quality of life. Speech-language pathologists are often consulted to assist in the restoration of swallow and communication, but due to the high prevalence of silent aspiration and complex laryngeal pathologies in this population, a clinical bedside swallow evaluation does not always suffice. Fiberoptic Endoscopic Evaluation of Swallowing (FEES) is an essential tool for evaluation of both the swallow mechanism and laryngeal integrity to determine readiness for oral intake and use of the Passy Muir Valve® to restore communication.

Artificial Airways and Swallow Function

Endotracheal Intubation

Artificial airway placement can have grave impact on both communication and swallow. Endotracheal intubation occurs when the lungs no longer function on their own and the primary objective of intubation is to establish a secure airway; however, once the patient is extubated and ready for rehabilitation, many impairments related to swallowing and voice restoration become evident. It is important for the clinician to note the environment of intubation and the endotracheal tube (ETT) size as these factors may impact the degree of laryngeal injury and subsequent swallow impairment. The circumstance in which a patient is intubated can either be controlled under visualization or emergent such as a roadside accident or sudden respiratory distress. Figure 1 provides an example of a "normal" patent airway post-extubation for comparison when considering negative impacts from intubation. Box 1 with figures 2 – 3 illustrates the consequences of an in-field intubation resulting in significant injury to the posterior glottis.

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It is important to understand the relationship between the size of the ETT as compared to the trachea. The ETT can vary in size with most common sizes being 7-7.5 mm for women and 8-8.5 mm for men (Karmali & Rose, 2020). The size refers to the inner lumen of the tube however, the actual tube itself is nearly 10mm or 20% larger as it occupies the trachea (Coyle, 2014). The tube size is chosen by the surgeon or respiratory therapist to ensure the inner lumen is large enough to manage secretions and provide adequate space for airflow (Karmali & Rose, 2020). The authors noted that the average tracheal diameter for men is 13 – 27 mm and 10 – 21 mm for women with the subglottic and cricoid cartilage being the narrowest area and subsequently where the ETT passes through (Randestad et al., 2000). They noted that in some women the diameter of the cricoid ring is small enough that even a 7mm ETT may cause injury to the mucosa.

Consequences of intubation include laryngeal injury (Brodsky et al., 2018; Colton House et al., 2011; Cooper, 2018; Huston & Naunheim, 2021; Miles et al., 2018; Pazak et al., 2021), swallow dysfunction (Brodsky et al., 2018; Miles et al., 2018), and aspiration which can lead to pneumonia or reintubation (Miles et al., 2018). Miles and colleagues (2018) studied endoscopy recordings of 106 patients who had been intubated and found the following results: 65% laryngeal edema, 61% vocal fold (VF) paralysis, 39% silent aspiration, and a 36% incidence of pneumonia.

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Laryngeal injury after extubation is well documented in the literature (Colton House et al., 2011; Huston & Naunheim, 2021; Meenan et al., 2021; Pazak et al., 2021; Scheel et al., 2016). Laryngeal pathologies can include edema, erythema, granuloma, vocal fold ulcerations, VF paresis or paralysis, and subglottic edema or stenosis (Colton House et al., 2011; Huston & Naunheim, 2021; Meenan et al., 2021; Pazak et al., 2021; Scheel et al., 2016;). Cooper and colleagues (2018) noted laryngeal injury may increase with larger endotracheal tubes and tubes left in same pressure spot and when patients who are combative or semi-conscious have the tube and larynx making constant contact.

Swallow dysfunction is another consequence of intubation and can often be the result of laryngeal injury along with other factors such as neuromyopathy, impaired cognition, reduced sensation, and respiratory-swallow incoordination. (Borders et al., 2019). Studies vary on incidence of post-extubation dysphagia ranging from 3% to 62% (Skoretz et al., 2010). Skoretz and colleagues (2010) conducted a systematic review looking at the incidence of dysphagia post-extubation and found the highest reported frequencies of swallow dysfunction occurred with prolonged intubation (>24 hours) and with highest reported dysphagia incidences of 62%, 56%, and 51%. Ambika and colleagues (2019) found statistically significant relationship between laryngeal injury and aspiration (see Box 2, Figures 4 -7). More specifically, Scheel and colleagues (2018) found a specific correlation of arytenoid edema to aspiration. Ajemian and colleagues (2001) used FEES to assess 51 patients who were intubated greater than 48 hours and found 56% were aspirators and of those 25% were silent.

There has been debate as to the timing of swallow evaluation post-extubation. Scheel and colleagues (2016) looked at 59 patients post-extubation utilizing FEES to assess for penetration and aspiration. They found that the occurrence of penetration and aspiration in those evaluated within or less than 24-hour post-extubation was 56.8% as compared to 60% of patients who were assessed greater than 24 hours. Timing of extubation and dysphagia assessment did not significantly change the outcome of their swallow function, therefore, the authors suggest it may not be necessary to wait to evaluate swallowing.

Tracheostomy Tubes

When a patient is unable to extubate safely, a tracheostomy tube may be placed to assist in ventilator weaning. Tracheostomy tubes are also placed when an upper airway obstruction such as laryngeal tumors, infection, or surgery prevent adequate air exchange (See Box 3, Figures 8 -9). It is important to know the condition and reason for the tracheostomy placement, as this can impact tolerance of a speaking valve and swallow function if an upper or lower airway obstruction is present. In a recent retrospective review by Marvin and Thibeault (2021), they found that 75% of patients who received a tracheostomy tube for oropharyngeal pathology aspirated. Of those who aspirated, 81% were silent. Oropharyngeal pathology was defined as oropharyngeal or laryngeal tumor, infection, or surgery (Marvin & Thibeault, 2021).

If the trach size appears appropriate, there may be other factors preventing tolerance of a one-way valve...

Much like endotracheal tubes, tracheostomy tubes vary in size and type which is important to be aware of when assessing for speaking valve placement as there must be enough space around the tube to pass air into the upper airway. Signs of poor tolerance include aphonia, strained voice, back pressure within the trach, and increased work of breathing. If the trach size appears appropriate, there may be other factors preventing tolerance of a one-way valve such as secretions and upper or lower airway obstruction which can be visualized during a FEES assessment.

The literature varies on the direct effect of tracheostomy tubes on swallow function. Recent studies have surmised that it is more likely the underlying medical diagnosis, complex medical course, and patient's overall deconditioning that necessitate the tracheostomy tube rather than the tube itself causing the dysphagia (Donzelli et al., 2006; Francis & Gelbard., 2014; Leder et al., 2005; Marvin & Thibeault, 2021). Dysphagia in this population is high given this list of considerations. Donzelli and colleagues (2006) looked at 40 patients with tracheostomy tubes; of those, 47.5% aspirated with 78.9% of those who aspirated being silent aspirators.

Although Passy Muir Valves are primarily known for their role in restoring voicing, research has also shown they play a role in improving swallow function and secretion management (Blumenfeld, 2021; Eibling & Gross, 1996; Gross et al., 2003). Establishing voice can give the clinician important acoustic information regarding vocal quality which may be predictive of laryngeal edema or other changes in function. Wallace & McGrath (2021) noted that stridor may indicate laryngeal edema, and hoarseness may be a sign of vocal fold dysfunction or pathology. Further, a wet vocal quality may indicate presence of secretions within the laryngeal vestibule. Marvin & Thibeault (2021) found aspiration was two times more likely with an open trach than a closed trach. Gross and colleagues (2003) hypothesize from their study that restoration of subglottic pressure stimulates receptors resulting in increased bolus speed, stronger pharyngeal muscle action, and increased pharyngeal contraction time. With this knowledge, ideally a patient would be assessed for speaking valve use at the time of or before a swallow evaluation.

FEES

A clinical bedside evaluation can give important information such as respiratory status, secretion management, and cognition; however, given the high incidence of silent aspiration in both post-extubated and tracheostomized patients, further instrumental assessment is warranted. FEES and videofluoroscopy are both useful; however, FEES is particularly helpful for these populations as it can be done at the bedside, identify laryngeal pathologies, and visualize secretion load which can predict a lot about swallow function. There is a high correlation of reduced secretion management with swallow dysfunction and silent aspiration (Donzelli et al., 2006; Miles et al., 2018; Murray et al., 1996). Miles et al. (2018) found that impaired secretion management significantly correlated with duration of tracheostomy, feeding tube duration, aspiration, and pneumonia. Specifically, secretions visualized within the laryngeal vestibule are highly predictive of aspiration of food and liquid (Donzelli et al., 2006; Murray et al., 1996). It should be noted that some laryngeal pathologies may obstruct complete view of the glottis making aspiration more difficult to visualize. In these cases, follow up with videofluoroscopy may be useful.

A clinical bedside evaluation alone may not be sufficient to determine safe diet initiation.

Summary

Artificial airway placement may significantly impact communication and swallow function. Silent aspiration and laryngeal pathologies are risk factors with this population that may impede restoration of a normal aerodigestive tract for speech and swallow. Thorough background of ETT size, circumstance of intubation, and means of tracheostomy tube placement are critical information for the SLP when evaluating this population. A clinical bedside evaluation alone may not be sufficient to determine safe diet initiation. Furthermore, trach tube size alone may not be the only factor preventing tolerance of a speaking valve given known risk for laryngeal pathologies. Assessment of laryngeal integrity with FEES may help to problem-solve speaking valve tolerance and aide in ENT consultation for early intervention of laryngeal pathologies to avoid long term issues. Speaking valve assessment in patients with tracheostomies should always be considered in conjunction with swallow evaluation as it restores subglottic pressure and improves secretion management therefore allowing better outcomes for swallow rehabilitation.



Figure 1: Patent airway post-extubation for reference

continued next page

Box 1



Figure 2: Bilateral ulcerative tissue



Figure 3: Significant laryngeal edema

66-year-old female admitted at level 1 trauma center for blunt TBI. Patient was intubated in-field and remained intubated for 11 days. Patient was extubated without need for tracheostomy but required a modified diet. Her airway was monitored closely.

Box 2



Figure 4: Pooling secretions; reduced glottic opening on abduction



Figure 5: Penetration to the level of vocal folds

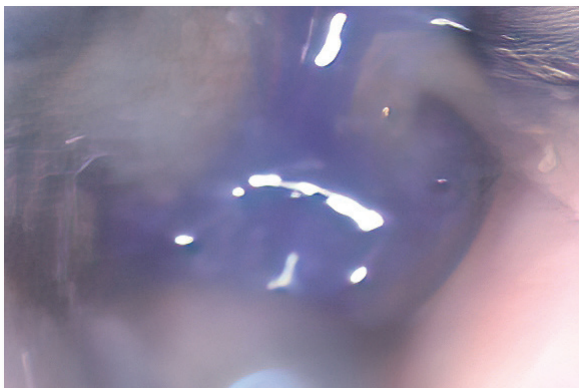


Figure 6: Penetration of melted ice chip mixed with secretions

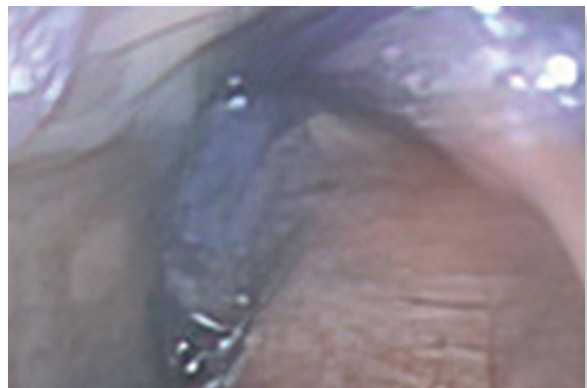


Figure 7: Silent aspiration of melted ice chip mixed with secretions upon inhalation

64-year-old male admitted for cardiac surgery - history of intubation with self-extubation using his tongue. He was reintubated and received a tracheostomy 3 days later. Patient was seen by SLP and was unable to tolerate the Passy Muir Valve. FEES revealed laryngeal edema and reduced glottic opening (Figures 4 and 5). Patient presented with severe swallow dysfunction characterized by silent aspiration of secretions and melted ice chip (PAS 8).

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Box 3



Figure 8: Laryngeal edema



Figure 9: Edema throughout laryngopharynx

46-year-old male presented to ED with tongue swelling and shortness of breath. Emergent tracheostomy placed after 3 unsuccessful intubations due to airway edema. FEES completed with recommendation for NPO except ice chips. PMV was only tolerated for short periods due to upper airway obstruction. Figure 8 illustrates the laryngeal edema secondary to an allergic reaction which necessitated an emergent trach.

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Tracheostomy and Mechanical Ventilation: Managing Dysphagia in the ICU

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Dysphagia is common in patients with tracheostomy and mechanical ventilation in the ICU. Consequences of dysphagia include aspiration, aspiration pneumonia, delayed resumption of oral intake, malnutrition, decreased quality of life, prolonged ICU and hospital length of stay, and morbidity (Altman et al. 2010; Wallace & Wilson, 2013; Wilmskoetter et al. 2017; Zuercher et al. 2019). For these reasons, early, safe, and evidence-based dysphagia management is crucial. To provide appropriate dysphagia intervention, an understanding of the correlation between tracheostomy and dysphagia, the impact of mechanical ventilation on swallowing function, the benefits of early dysphagia intervention, and best practice for assessment and treatment of dysphagia is necessary.

Tracheostomy Tubes, Mechanical Ventilation, and Swallowing

Research suggests that the presence of a tracheostomy tube, especially with an inflated cuff, may alter sensorimotor actions needed for an intact swallow. Wallace & Wilson (2013) investigated aspiration risk and safety of oral feeding in patients with tracheostomy and mechanical ventilation with the cuff inflated. The authors reported that 70% of patients aspirated, and 83% of these were silent aspirators. There is also a likely correlation between critical illness polyneuropathy and dysphagia in this patient population. Ponfick et al. (2015) reported that 91% of patients with critical illness polyneuropathy (CIP) and tracheostomy exhibited dysphagia. The authors reported that dysphagia in CIP may result from various contributing factors, including a “learned nonuse” of swallowing muscles during prolonged ICU treatment. Additionally, changes in smell and taste (Tsikoudas et al., 2011), reduced hyolaryngeal excursion (Amathei et al., 2012), lack of subglottic air pressure (Gross et al., 2003), impaired breathing and swallowing coordination (Prigent et al., 2011), and impaired cough function (Park et al., 2018) are related to the presence of a tracheostomy tube and cuff, which may negatively impact swallow function.

Early intervention may have a positive impact on swallowing outcomes.

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Importance of Early Intervention

Waiting to assess swallowing until the patient has weaned from the ventilator or discharged from the ICU may result in exacerbation of dysfunction. Conversely, early intervention may have a positive impact on swallowing outcomes. Fröhlich et al. (2017) examined early intervention with use of a team approach for patients with tracheostomy and mechanical ventilation. One of the parameters reviewed in their study was the timing from tracheostomy to oral intake. The authors concluded that with early intervention and in-line Passy Muir® Valve (PMV®) use, ventilated intensive care patients had improved swallowing with earlier oral intake than in those patients without early intervention.

Cuff Deflation and Use of the Passy Muir Valve

In many instances, a deflated cuff and use of the PMV improves swallowing efficiency and safety. The PMV restores positive airway pressure and airflow to the upper airway. Research has shown that this redirection of airflow assists with improving sensory awareness, secretion management, cough, and minimizing occurrences of aspiration (O'Connor et al., 2019). Marvin & Thibeault (2021) investigated swallowing in patients with tracheostomy in several conditions, without a speaking valve or cap compared to with a speaking valve or cap. The authors reported that the odds of aspiration were twice as high in patients with uncapped tracheostomy tubes compared to closed tracheostomy tubes (i.e., cap or speaking valve in place). Odds of silent aspiration were 4.5 times greater with an uncapped tracheostomy tube. Additionally, use of the PMV may improve breathing

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and swallowing coordination by restoring the post swallow expiration. Prigent et al. (2011) investigated the effect of a speaking valve on breathing-swallowing interactions and on the volume expelled through the upper airway after swallowing. The authors found that expiratory flow towards the upper airway after swallowing was negligible without the speaking valve and was restored by adding the speaking valve. Based on these findings, cuff deflation and PMV use should be considered to minimize aspiration risk.

However, research regarding dysphagia and tracheostomy is variable. In a recent systematic review, Goff and Patterson (2018) concluded that patients with a tracheostomy should have a swallowing evaluation, regardless of cuff condition. They recommended that patients be evaluated on a case-by-case basis to determine readiness to return to oral nutrition. The authors acknowledged that to date, research had not presented a consensus to establish a standard of care for tracheostomy and cuff management as they relate to swallowing. Skoretz et al. (2020) also conducted a scoping review of the literature and found inconsistencies regarding the impact of cuffs and tracheostomy tube occlusion. So, while cuff deflation and PMV use may have a positive impact on swallowing for some patients, it should not be a prerequisite for dysphagia assessment. Some patients may be able to swallow efficiently with the cuff inflated, even during mechanical ventilation. Thorough assessment and individual decision-making are essential.

Modes of Ventilation and Swallowing

Higher modes of ventilation which have a mandatory breath rate, such as controlled mandatory ventilation (CMV) also known as assist control (AC), may result in the patient having less control over the timing of breathing and swallowing. For example, in volume control (VC) or pressure control (PC), a breath could be delivered mid-swallow. For some patients, this dyssynchrony may negatively impact swallowing. In contrast, spontaneous modes of ventilation which do not have a set breath rate, such as pressure support, may result in improved breathing and swallowing coordination. While this is a consideration, it does not indicate that all patients in VC or PC will exhibit dysphagia. Some patients swallow safely and efficiently even in higher modes of ventilation. Therefore, speech-language pathologists (SLP) should not base decisions regarding swallowing intervention solely on the level of ventilatory support a patient is receiving.

Although modes of ventilation are a consideration, individual decision-making is needed. Patient readiness criteria for a dysphagia assessment in many cases may focus on being medically stable and alert enough to participate. Using overly stringent standards to determine patient candidacy for a swallowing evaluation could result in eliminating patients who may be able to swallow safely and efficiently and could delay necessary dysphagia intervention.

Clinical Swallowing Evaluation

Dysphagia assessment typically begins with a clinical swallowing evaluation (CSE). To conduct a comprehensive CSE, airflow to the upper airway is needed. This allows the SLP to assess voice, cough, and speech during the oral mechanism exam and to interpret signs and symptoms of aspiration such as cough and changes in vocal quality during oral trials. To achieve airflow to the upper airway with a tracheostomy tube and with mechanical ventilation, the cuff must be deflated and, if possible, a PMV should be placed on the tracheostomy tube hub or in-line with mechanical ventilation. If this is not possible, an instrumental examination should be performed before making any diet or treatment recommendations.

One adjunct to the CSE is the Modified Evan's Blue Dye Test (MEBDT), which is a screening tool to detect aspiration of secretions, liquids, and food in patients with tracheostomy tubes. The MEBDT involves adding blue food coloring (typically FD&C Blue No.1) to foods and liquids that are administered during a clinical swallowing evaluation and monitoring tracheal secretions for evidence of blue coloring, however, there are several limitations to the MEBDT. First, if the test is positive, the SLP only knows the patient aspirated but does not have information regarding when or why the aspiration occurred. Second, if the tracheostomy cuff is inflated, material that is aspirated may not be immediately visualized as it takes time to seep around the cuff into the lower airway. Third, false negatives have been reported (Donzelli et al., 2001; Belafsky et al., 2003), so aspiration may be missed. However, it is important to mention that more recent research has reported the MEBDT to have good specificity, no false positives, and sensitivity for identifying aspiration (Béchet et al., 2016; Fiorelli et al., 2016).

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In general, the CSE in the ICU may be quite limited with a focus on information gathering to help the SLP make decisions regarding next steps in the assessment. A Videofluoroscopic Swallowing Study (VFSS) or Flexible (Fiberoptic) Endoscopic Evaluation of Swallowing (FEES) should be strongly considered for these patients due to the risk of silent aspiration and to obtain more objective information about swallowing function.

Instrumental Swallowing Evaluations

FEES and VFSS are valuable examinations for use with this patient population. These tests show good diagnostic agreement for aspiration, penetration, residue, diet level, and compensatory strategy recommendations (Brady & Donzelli, 2013). Although both are considered gold standard swallowing assessments, there are some advantages of FEES in the ICU for patients with tracheostomies and mechanical ventilation including:

- **View.** Visualization of mucosa, structures, and vocal folds. This can be particularly useful to assess for evidence of intubation trauma.
- **Duration.** Potential for longer duration of exam. This is beneficial, especially if assessing the patient in various conditions such as cuff inflated, cuff deflated, and in-line PMV which require extra time.
- **Portability.** Conducting a FEES in the patient's room, rather than transporting the patient to radiology for a VFSS is often easier and less fatiguing for the patient. Additionally, the portability of FEES allows the medical staff to remain in the ICU rather than leaving the floor to accompany the patient to radiology for a VFSS.
- **Secretions.** Visualization of secretions for better management.
- **Repeatability.** May be repeated with more frequency, during meals, and during treatment.

Timing of the instrumental exam is dependent on many factors such as medical stability, mental and respiratory status, and trajectory of illness.

Cuff and Valve Status During the Instrumental Swallowing Assessment

The instrumental swallowing evaluation should be performed in the patient's potential meal-time conditions. For instance, a patient may have an in-line PMV placed in the ICU, but that may not be the patient's condition throughout the entire day. Therefore, the SLP often needs to assess the patient in multiple conditions – cuff inflated, cuff deflated, and cuff deflated with in-line PMV. Since the respiratory therapist (RT) will need to be present for in-line PMV placement, RT and SLP coordination and teamwork are needed. If swallowing efficiency and safety differences are noted based on the cuff and PMV status, recommendations should reflect those findings.

Dysphagia Treatment Considerations

Early dysphagia intervention in the ICU may lead to improved outcomes. Rodrigues et al. (2015) studied the feasibility of a swallowing therapy program in patients with tracheostomy and mechanical ventilation. Seventy-eight percent of patients who participated in the swallow therapy program were able to receive oral feeding while in the ICU. The authors reported that swallowing intervention during mechanical ventilation is feasible and may help to improve swallowing function and allow for the initiation of eating and drinking in the ICU.

The following factors should be considered when developing a dysphagia treatment program for this patient population:

- Etiology of dysphagia
- Respiratory status and modes of ventilation
- Instrumental exam findings
- Mental status and ability to participate in a therapy program
- ICU team input
- Patient goals of care
- Health status
- Dependence on feeding and oral care
- Tracheostomy tube cuff status
- Ability to use an in-line PMV

Dysphagia Treatment May Include:

- **In-Line PMV.** Cuff deflation and in-line PMV may begin the process of oropharyngeal and laryngeal rehabilitation as airflow to the upper airway and positive airway pressure are restored. An initial goal of dysphagia therapy may be improved secretion management. Cuff deflation and in-line PMV may allow for improved sensation of secretions and improved cough effectiveness. O'Connor et al. (2019) conducted a systematic review to investigate the physiological and clinical outcomes associated with use of the PMV. Statistically significant improvements in secretion management with use of the PMV were found. Additionally, use of a PMV may minimize aspiration risk (Marvin & Thibeault, 2021; O'Connor et al., 2019; Wallace & Wilson, 2013).
- **Ice Chip Protocol.** Although ice chip protocols have not been researched in this patient population, the detrimental impact of prolonged nil per os (NPO) is well-known. (Crary & Groher, 2006; Langmore et al., 2012; Robbins et al., 2008; Shune et al. 2015). Disuse of the swallowing mechanism may result in muscle atrophy as well as a diminished cortical representation which may pose a threat to functional recovery (Robbins et al., 2008). Small amounts of ice chips may minimize the negative consequences of a strict NPO status. The theory supporting ice chip protocols is the same as water protocols which have shown that rate of pneumonia is not increased in dysphagic patients who take water orally with a structured protocol in place (Bernard et al., 2016; Carlaw et al., 2012).

Pisegna and Langmore (2018) studied the implementation of an ice chip protocol in patients with severe dysphagia who were NPO. The authors reported that in 77.8% of the patients studied, secretion amount and location improved. They summarized that clinical experience suggested the ice chip protocol was a safe and successful protocol to both evaluate and rehabilitate dysphagia where other boluses may not have been as successful. Pisegna and Langmore (2018) also reported on several anecdotal cases where ice chips were used in a rehabilitative fashion and moved patients to recover the swallow. They suggested that the use of ice chips may be the best way to start an evaluation when a history of reduced use or nonuse is a consideration.

- **Compensatory Strategies.** Many compensatory strategies, such as postural changes or techniques to alter bolus flow, for patients with tracheostomy tubes are the same as strategies used for patients without a tracheostomy tube. However, there are some strategies, such as the supraglottic swallow and super-supraglottic swallow, which require upper airway airflow and subglottic pressure for cough and swallow. These strategies would not be effective for patients who require cuff inflation. Cuff and PMV status should be considered when making recommendations for use of compensatory strategies.
- **Rehabilitative Therapy.** Low intensity and frequency of traditional and device-driven exercise may be considered in this patient population. If an exercise program is recommended, safety considerations are paramount. Vital signs and tailoring exercises according to the patient's ability level and overall status are needed. Additionally, it is important to remember that some dysphagia exercises may cause a rise in blood pressure, cardiac arrhythmias, and dyspnea and may be contraindicated in certain patient populations (Barker, 2020; Chaudhuri, 2002) Consultation with the medical team may help determine if a patient is safe to perform an exercise regimen.

While traditional swallowing exercises may be recommended, it is important to consider whether exercises will be performed when the cuff is inflated or deflated. For some exercises, upper airway airflow and positive pressure are needed. To achieve both effective airflow to the upper airway and cough requires cuff deflation and in-line PMV. For example, the supraglottic and super-supraglottic swallows require a breath hold and cough, the Mendelsohn requires a prolonged breath hold, and the effortful pitch glide requires airflow for phonation. These exercises could not be executed as intended with the cuff inflated.

Additional Interventions

A device-driven exercise which may be beneficial for patients with tracheostomies and mechanical ventilation is respiratory muscle training (RMT). RMT is an intervention designed to strengthen the muscles of respiration and includes inspiratory muscle training (IMT) and expiratory muscle training (EMT). There is a growing body of evidence which supports the use of EMT to improve swallowing, airway protection, and

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cough strength across multiple patient populations, including critical illness and tracheostomy (Brooks et al. 2019; Clayton et al., 2022; Hutcheson et al., 2018; Wang et al., 2019). EMT may be considered as a dysphagia treatment once the patient is medically stable and able to tolerate an in-line PMV. Use of an in-line PMV is needed since airflow through the upper airway must occur to exhale out the mouth and through the EMT device. When working with this patient population, adjustments to the typical EMT regimens may be needed. Some patients in the ICU may need low resistance, fewer repetitions, and rest breaks. Additional considerations for EMT in the ICU include collaboration with respiratory therapy, ICU team clearance and education, and protocol development (Opalinski & Hanley, 2022).

Another intervention which may be appropriate is respiratory swallow training (RST). This intervention targets breathing and swallowing coordination and teaches patients to swallow mid-expiration. For patients requiring cuff inflation, ventilator modes which have a mandatory breath rate, or both, this training would not be feasible since their breathing on expiration is impacted by other factors. However, for patients who can tolerate cuff deflation and in-line PMV with spontaneous modes of ventilation, RST may be both feasible and beneficial.

Summary

Research has shown that early intervention in patients with tracheostomy results in faster return to oral diets, improved diet tolerance, and improved overall nutrition (Frölich et al., 2017; Mah et al., 2016; Welton et al., 2016). Assessment usually begins with a clinical swallowing evaluation followed by an instrumental examination. In many cases, FEES is the ideal assessment for this patient population. Once the instrumental assessment has been completed, and the SLP has considered the whole clinical picture, recommendations are made. If appropriate, dysphagia intervention begins. Treatment regimens for patients with tracheostomies and mechanical ventilation may include in-line PMV, ice chip protocols, compensatory strategies, respiratory swallow training, traditional swallowing exercise, and device-driven rehabilitative therapy. Critical thinking and ICU teamwork are necessary to design individualized dysphagia interventions which are safe and yield the best patient outcomes.

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Article Summaries

Effect of a Speaking Valve on Biomechanical Properties of Swallowing

Han X., Dou, Z., & Wei, X. (2018). Effect of a speaking valve on biomechanical properties of swallowing and the upper airway flow characteristics for tracheostomized patients after acquired brain damage. *Annals of Physical and Rehabilitation Medicine*, 61, 221. <https://doi.org/10.1016/j.rehab.2018.05.511>

The authors investigated the impact of the Passy Muir Valve® (PMV®) on swallowing, upper airway flow, and swallowing and breathing interaction for patients with acquired brain injury and tracheostomy. Six patients with tracheostomy who were able to tolerate the PMV and eight healthy volunteers were enrolled. Videofluoroscopy and high-resolution manometry were performed to evaluate swallowing with and without the Passy Muir Valve. The authors reported that use of the PMV resulted in improved hyoid superior movement, UES opening diameter, and upper airway airflow and pressure in patients with acquired brain damage and tracheostomy.

Predictors of Aspiration and Silent Aspiration in Patients with Tracheostomy

Marvin, S., & Thibeault, S. L. (2021). Predictors of aspiration and silent aspiration in patients with new tracheostomy. *American Journal of Speech-Language Pathology*, 30(6), 2554–2560. https://doi.org/10.1044/2021_AJSLP-20-00377

The authors researched the frequency of aspiration and silent aspiration in patients with a new tracheostomy. One variable the authors evaluated was open tracheostomy tube vs. closed tracheostomy tube with a cap, plug, or one-way speaking valve. The authors reported the odds of aspiration were twice as high in patients with uncapped tracheostomy compared to closed (i.e., cap or speaking valve in place). Odds of silent aspiration were 4.5 times greater with an uncapped tracheostomy. The authors stated that patients with new tracheostomy are at risk for aspiration and benefit from speech pathology intervention and instrumental swallowing evaluations



Penetration, Aspiration, Pneumonia, Oh My! Palliative and Hospice Concerns in Dysphagia Management at the End of Life

Maria Bauman, MA, CCC-SLP
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Elizabeth Koster, MS, CCC-SLP

As speech and language pathologists (SLP), we are consistently presented with the challenges of managing dysphagia. For those of us who work in geriatric specialty centers, additional challenges in this area are a frequent occurrence. Traditionally, the focus of care for all patient populations has been on mitigating aspiration risk in the context of managing dysphagia. This is especially true in the elderly population, perhaps more so due to the fragile nature of these patients. The fear of aspiration in our field may have grown beyond the level of a “healthy fear.” More recently, treatment trends have shifted to consideration of risk factors for adverse events versus a focus on the risk of aspiration. This approach puts an emphasis on quality of life as well as safety. As rehabilitation specialists we need to shift our focus from “risk of aspiration” to “risk of adverse events” with an emphasis on quality of life, which is easier said than done. Our colleagues in palliative care and hospice care are no strangers to incorporating quality of life into treatment plans and should always be a part of the care team when considering dysphagia management at the end of life (EOL).

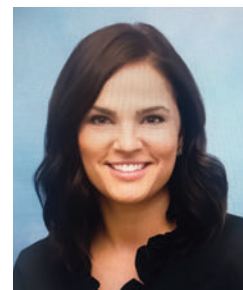
Exploring the complex decision-making process regarding nutrition recommendations and dysphagia management in the very elderly population, particularly in end-of-life situations, is an area for discussion. The thought to use alternative means of nutrition to reduce risk of aspiration with oral intake is not necessarily the best solution.

Quality of Life Considerations

According to McHorney and colleagues (2000), the human experience of living with difficulty swallowing may cause a variety of negative psychosocial responses, including anxiety, embarrassment, fear, and reduced self-esteem. Clinicians must remember that alternative means of nutrition, particularly in the case of patients with advanced dementia and at the end of life, may result in increased agitation, increased use of physical or chemical restraints, increased potential for tube-related complications,

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and an increased risk for the development of pressure ulcers. Current research has found that up to 32% of patients receiving palliative and hospice care experience dysphagia (Kenny et al., 2019). Unfortunately, the impact of dysphagia on those patients' quality of life has not been well researched, begging the question, does dysphagia have negative implications on a patient's symptoms and overall quality of life? If so, to what extent?

The Swallowing Quality of Life (SWAL-QOL) is a 44 item, validated questionnaire that assesses ten quality of life concepts: burden, eating duration, eating desire,

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symptom frequency, food selection, communication, fear, mental health, social, sleep and fatigue, and scored from 0-4 (worst to best, respectively) (McHorney et al., 2000; McHorney et al., 2002). A study completed by Tan et al. (2021) compared the symptoms and quality of life of palliative care patients with and without dysphagia. The study consisted of 81 participants residing in an inpatient palliative care unit. A swallow screen was completed with all participants to identify dysphagia, and if appropriate, they were referred to the SLP for management. It should be noted, these participants were verbally communicative, had no known cognitive impairment, and were on a complete oral diet or tube feeding augmented with an oral diet. The participants with dysphagia were found to have a statistically significant lower SWAL-QOL score compared to participants without dysphagia. Specifically, the lower scores were in the following categories related to quality of life: burden, eating desire, eating duration, symptoms, food selection, communication, and mental health. Regarding swallow symptoms, throat clearing, choking with liquids, choking with food, and coughing were found to be the more prevalent issues in patients with dysphagia compared to those without dysphagia.

The results of this study found that patients with dysphagia reported a worse quality of life when compared to those patients without dysphagia. While one might expect an increased prevalence in the domains of burden and eating duration in patients with dysphagia, the fact that communication was consistently identified as an issue should raise concerns. While communication should be a focus throughout healthcare, one could argue it should be even more at the forefront when caring for patients at the end of their lives. The consistent report of reduced quality of life in the communication domain of the SWAL-QOL shows just how important it is to provide care and access to communication for patients at the end of their life. Does the patient feel that their wishes and goals are heard and that their symptoms are managed accordingly?

Role of the SLP

Speech-language pathologists should be keenly aware of whether the patient is receiving palliative or hospice care or if discussing a referral to a geriatric specialist or palliative care physician would be prudent. SLPs must also consider the patient's primary goal when determining an appropriate plan of care. This goal may involve coming to a decision that meets the patient's emotional and social needs in addition

to life-prolonging treatment, or it may have a primary focus on the promotion of comfort and quality of life. As a member of the palliative care team, the SLP's role may shift to focus primarily on assessment of swallow function. Following assessment, the SLP's role includes provision of patient and caregiver education, training, and support; however, the patient and family may not elect to have an alternative means of nutrition or diet modification, and a rehabilitation model may not be pursued. It is the education from the team members, including the SLP, that helps in this decision process.

EOL Considerations

Levy and colleagues (2004) compiled helpful information regarding the management of dysphagia in adults who are approaching the end of their lives. This resource provides an overview which addresses appropriate interventions and considerations when facing dysphagia at end of life. A primary question that often arises is regarding artificial nutrition. Though artificial means of nutrition and hydration may prolong a patient's life, the clinician must consider at what cost. The American Academy of Hospice and Palliative Medicine has a position statement that indicates use of artificial means of nutrition and hydration have the potential to make the dying process more painful and increase suffering for patients because metabolic function deteriorates, and the body can no longer effectively utilize nutrition and hydration regardless of the source (AAHPM, 2013). Of note, dehydration in patients at the end of life may create an analgesic effect, actually increasing patient comfort (Post, 2001; Smith & Andrews, 2000). These patient populations include those with terminal illness; chronic, progressive illnesses; and advanced dementia.

Determining which patients are considered EOL involves collaboration with multiple members of the medical team; a review of the patient's prior level of function; medical, nutrition, and hydration statuses; and most importantly, patient and family wishes. Brown's End of Life Decision Tool (Levy et al., 2004) may be a helpful resource to assist a multidisciplinary team in weighing these factors. A risk-benefit assessment is important to convey to the patient and family regarding each possible avenue.

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Other factors to weigh in the decision-making process include taking patient values, quality of life factors (religion, cognitive, psychosocial, spiritual factors), and contextual features (social, cultural, financial, legal, institutional, family, and burden of care factors) into consideration. When determining options for therapeutic intervention design, one example would be the determining use of a timed trial (i.e., specific number of days or weeks) of an oral diet. Temporary tube feeding may occur with a plan to re-evaluate at the end of the interval. If a patient chooses to acknowledge risk of aspiration and continue eating and drinking, they should be supported in making that decision.

Training and communication among all members of the medical team is imperative.

More recent research has supported a coordinated approach to eating and drinking with acknowledged risk in lieu of opting for tube feed placement (Soar et al., 2021). Though a protocol may be helpful to guide collaborative decision-making for these patients, training, and communication among all members of the medical team is imperative. Palmer and Padilla (2022) compiled a literature review assessing risks of adverse reactions in people who aspirate. Current research shows that aspiration and adverse reactions such as pneumonia are not one in the same; one does not equal the other. As clinicians, we must consistently assess the risk factors for adverse reactions and educate patients and their caregivers about those risks. When working with patients who are considering palliative or hospice care, it is prudent to acknowledge quality of life during those discussions and to determine if eating and drinking by mouth despite risks of aspiration brings more comfort than having a feeding tube placed, which is not without risks of aspiration and other complications.

Importance of Documentation

Documentation is of the utmost importance in these cases and should include information from the patient's living will or durable power of attorney for healthcare. Documentation allows improved communication between treating healthcare professionals and keeps a record to allow for improved care. Treatment sessions may focus on educating families on compensatory feeding techniques and strategies that may minimize some of the factors that increase the risks of aspiration, though it is not possible to eliminate risk.

Documenting the specifics of the techniques that are used maintains consistency. Proper documentation and allowing the patient and family a safe space to ask questions of the healthcare providers managing their care and having a sensitive disposition while discussing these difficult topics are key.

Conclusion

Management of dysphagia is a complex task requiring consideration of medical status, psycho-social factors, and quality of life. Unfortunately, there are no hard rules; however, fear of aspiration cannot be the only driving force in the decisions made as treating clinicians. It has been well documented that individuals with dysphagia have a reduced quality of life. Traditionally, the tendency has been to recommend alternative means of nutrition when the severity of dysphagia carries a high risk of aspiration; however, when we consider the negative effects of alternative nutrition, this approach is often considered less than optimal.

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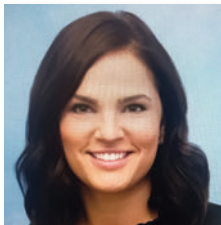
Featured Authors

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Carmin Bartow, MS, CCC-SLP

Carmin Bartow is a speech-language pathologist (SLP) with over 20 years of clinical experience treating patients in acute care. She has special interest in swallowing and swallowing disorders, head and neck cancer, and tracheostomy and mechanical ventilation. She was instrumental in developing the tracheostomy team in her previous position as an SLP at Vanderbilt University Medical Center. She is frequently an invited speaker at both the state and national levels and has authored a variety of papers. She is currently with Passy-Muir, Inc. as a full-time Clinical Specialist.



Maria Bauman, MA, CCC-SLP

Maria Bauman is a speech language pathologist with nine years of clinical experience predominantly in the acute care setting. Areas of clinical interest and expertise include dysphagia management in the TBI, ACDF, post-cardio thoracic surgery and organ transplant patient populations, as well as goals of care in dysphagia management. Maria is certified in the areas of MBSiMP, MDPT, and LSVT.



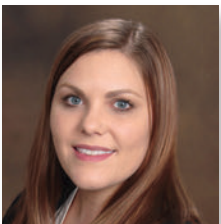
Jamie Demond, MS, CCC-SLP

Jamie Desmond MS, CCC-SLP received a BA from SUNY New Paltz and received an M.S. in Speech Language Pathology from New York Medical College. Jamie's clinical experiences include evaluation and treatment of pediatric feeding/swallowing, airway, cognitive-linguistic, speech and language disorders for medically complex, pediatric patients.



Jessica Farris, MS, CCC-SLP

Jessica Farris is a speech-language pathologist with 10 years' experience working in a medical setting, specifically in inpatient rehabilitation and acute care/intensive care settings. Areas of clinical expertise include management of complex dysphagia and communication deficits following acute neurological events, post cardio-thoracic procedures, and post prolonged intubation. Areas of particular interest include completion of instrumental studies for dysphagia management, evaluation and management of dysphagia in critical care/intensive care settings, and evaluation and management of dysphagia and communication deficits in following acute neurological events. When not at work, you will likely find Jessica tending to her vegetable garden or baking a special treat with her husband and 2 children.



Elizabeth Koster, MS, CCC-SLP

Betsy earned her Master's degree from the University of Wisconsin-Milwaukee in 2007. She has experience in a variety of settings and has focused her career on the brain injury population with specialized training evaluating and treating individuals with tracheostomies and swallowing disorders. She is currently a Speech Language Pathologist at the Rehabilitation Hospital of Michigan in Detroit, MI.

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Featured Authors

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Kristin King, PhD, CCC-SLP

With over 25 years of experience in medical settings, academia, and industry, Dr. King brings a unique perspective to care of patients with medical diagnoses. Her experience included a clinical focus on critical care and trauma, with an emphasis on TBI and trach/vent patients. As a professor, she conducted research and published in peer-reviewed journals on TBI and swallowing disorders. She continues her career by working in industry to improve patient outcomes through the development of multi-media education and participating in product development and regulatory requirements for medical devices. She is the host of the CAM Podcast for Passy Muir, editor of *Aerodigestive Health* by Passy Muir, and contributes regularly at the state, national, and international levels for both speaking and clinical papers. She also is co-editor of the book *Tracheostomy and Ventilator Dependence in Adults and Children: Learning Through Case Studies*.



Elizabeth Norberg, MS, CCC-SLP

Elizabeth Norberg, MS, CCC-SLP has been a speech-language pathologist for 17 years, primarily in acute care. She earned her master's degree from University of Alabama. Elizabeth's specialties include diagnostics and treatment of swallow dysfunction in medically complex; artificial airways; FEES for assessment upper aerodigestive tract, and head and neck cancer.



Stephanie Waters, MS, CCC-SLP, CLC, TSSLD

Stephanie A. Waters, MS, CCC-SLP, CLC graduated from SUNY Geneseo with a BS in Speech and Language Disabilities and from New York Medical College with a M.S. in Speech-Language Pathology. She is a Certified Lactation Counselor and works at St. Mary's Hospital for Children specializing in pediatric feeding disorders, airway management, and augmentative and alternative communication.

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