# TABLE OF CONTENTS

| Who we are: OSLHA and eHearsay                      | 2 |
| In this Issue                                      | 3 |
| Donna Edwards                                     |   |
| Clinical Focus:                                    |   |
| Oropharyngeal Strengthening for Swallowing Rehabilitation | 5 |
| Jacqueline Hind                                   |   |
| Through Thick and Thin: Clinical Perspectives On Consistency Modification | 11 |
| Brent Archer and Emily Russell                    |   |
| A Case of Lance-Adams Syndrome: The Clinical Process of the Evidence-Based Clinician | 19 |
| Annette Askren and Paula Leslie                   |   |
| Feeding the Infant with Cleft Lip and/or Palate: Tips for the First Year of Life | 23 |
| Lauren Madhoun                                     |   |
| Anterior Cervical Disc Fusion (ACDF) and Dysphagia: What We Know So Far | 28 |
| Jolene Lawton                                      |   |
| What Does Diabetes Have to Do with Cognition and Swallowing? | 35 |
| Marnie Kershner and Paula Leslie                  |   |
| Multisystemic Impact of Frailty and Sarcopenia on Swallowing Function and Dysphagia | 39 |
| Donna Edwards                                     |   |
| CEU Questions (directions & worksheet for earning online CEU’s) | 46 |
| Guidelines for Submission to eHearsay              | 50 |
| Open Call for Papers                               | 52 |
| In the Next Issue                                  | 52 |
MISSION:
Empowering our members by providing opportunities for professional development, advocacy, and leadership development necessary to foster excellence in the services provided to individuals with communication and related disorders.

HISTORY:
Founded in 1945, the Ohio Speech-Language-Hearing Association (OSLHA) is a professional association representing speech-language pathologists and audiologists throughout Ohio. OSLHA is recognized by the national American Speech-Language-Hearing Association (ASHA) as the official professional organization for Ohio. OSLHA members provide services for the evaluation and rehabilitation of communicative disorders. Members work in a variety of settings including; clinics, health care facilities, hospitals, private practice, schools, and universities. Members must abide by the OSLHA Code of Ethics.

eHearsay, the electronic journal of the Ohio Speech-Language-Hearing Association, is designed to address the professional development needs of the state association. Issues are developed around specific themes and can include invited papers, research articles, review, tutorial, research forum, letter to the editor, clinical focus/forum or viewpoints.

eHearsay is published as a web journal annually. Continuing education credits will be available for each issue.
I am delighted and honored to serve as editor to bring the eHearsay Dysphagia issue to the OSLHA membership. This has been a long-term project inviting authors across the nation to submit articles for your continuing dysphagia education. The first article is entitled ‘Oropharyngeal Strengthening for Swallowing Rehabilitation’ by Jackie Hind. In her work, she considers the impact of physiological weakness associated with dysphagia and the current evidence-based practices that foster advancement in technological pursuits related to oropharyngeal strengthening. The article reinforces critical thinking of parameters associated with the principles of strength training, namely resistive load, repetition, frequency and specificity.

The second article is entitled ‘Through Thick and Thin: Clinical Perspectives on Consistency Modification’ submitted by Brent Archer. Discussion is held on diet modification of foods and liquids that is currently implemented across the lifespan. Though the article specifies adults with dysphagia, it is appropriate for service across the lifespan to certain patients diagnosed with dysphagia. The submission explores a basic understanding of diet modification before delving into the evolution from the National Dysphagia Diet to the International Dysphagia Diet and IDDSI protocols that can be found at https://iddsi.org/. The authors next pursue associated risks related to diet modification in order to enrich our awareness and further optimal patient care. Consideration of client perception, preferences and level of functioning are supported for a dynamic informed decision-making process.

The next article, ‘A Case of Lance-Adams Syndrome: The Clinical Process of the Evidence-Based Clinician’ by Marni Kershner and Paula Leslie, presents us with a case study on Lance-Adams syndrome and the clinical picture crafted by a clinician using evidence-based management. The submission reinforces our professional ethical duty and due diligence to search out current research evidence. Weaving the known research for diagnostic consideration with client presentation and perceptions, individualizes treatment approaches for an optimal, function outcome. Support is provided for an interdisciplinary team approach during needed treatment.

The fourth article, by Lauren Madhoun, entitled ‘Feeding the Infant with Cleft Lip and/or Palate: Tips for the First Year of Life’ focuses on infants born with cleft lip and/or palate with attention to initiation and modification of early feeding practices. As in previous articles, an interdisciplinary approach is supported to meet the needs of the patient and the family. Neonatal development and physiologic function are presented in detail. Feeding parameters include both breast and bottle-feeding considerations in light of the inherent reduction in oromotor pressure needed to efficiently obtain sufficient nutrition. Use of supplemental nutrition and a variety of feeding systems/utensils are presented with emphasis placed on selection of the supports the most efficient approach to enhance successful feeding for each individual infant. Typical infant feeding guidelines are shared while related to growth, development and diet advancement. Consistent consultation with the craniofacial team is recommended.
‘ACDF and Dysphagia: What We Know So Far’ was submitted by Jolene Lawton. The article discusses theories of underlying etiologies for dysphagia resulting from anterior cervical disc fusion. Pathophysiology and surgical interventions are summarized. Evidence-based practice is deemed critical. The author offers an examination of multiple studies sharing incidence values following questionnaires and/or instrumental assessments. She gives a detailed account of the physiological changes following anterior cervical disc fusion before presenting the theories of recurrent and superior laryngeal neuropathy, vocal fold paresis and dysphagia post-surgical intervention. Consideration of prognostic indicators is proposed followed by treatment options to consider or avoid in this population.

Marnie Kershner and Paula Leslie bring us the article ‘What does Diabetes have to do with Cognition And Swallowing?’. Understanding the presence of common concomitant chronic medical conditions that present in the clients we serve is critical to establishment of comprehensive care. This submission increases our awareness of the possible impact of diabetes mellitus on swallow function and cognitive status. Reduced executive function may negatively impact autonomy in self-management of medications. In addition, the physiological changes related to diabetes may negatively impact function of the digestive and gastrointestinal tracts and mealtime habits. The article defines and differentiates Type I and Type II diabetes along with effects on endocrine and vascular function. Poor oral hygiene, xerostomia, esophageal dysmotility, gastroesophageal reflux disease, and constipation are but a few of the noted impacted factors. A thorough discussion of polypharmacy is offered to foster critical review of possible medication side effects and interactions. The role of the SLP is presented with careful thought to treatment management along with interdisciplinary options.

‘Multisystemic Impact of Frailty and Sarcopenia on Swallow Function and Dysphagia’, the article by Donna Edwards brings our issue to its conclusion. The relationship and cyclical impact of aging and frailty influences biological and physiological substrates for our patients. Both frailty and sarcopenia are defined. Critical thinking in clinical care is explored with noted impact of concomitant complications related to the aging process and presentation of frailty. Attention is given to the pathophysiological impact on the body given inadequate nutritional support and declining micronutrients resulting in tissue, protein and carbohydrates needed for cell energy and metabolism. Preventative measures are offered to offset pathophysiological decline. The cyclical impact is next related to swallow function, related to proposed fatigue at mealtimes, and physiological swallow substrates. Reported imaging studies are presented to enhance our awareness of markers found during instrumental and neuroimaging assessments. The conclusion discusses future adaptations in current clinical and research practices. An active multidisciplinary approach and dynamic informed patient decision making process is yet again supported.

Thank you for your support of the OSLHA eHearsay dysphagia issue. It is hoped that the educational articles within have enhanced critical thinking to optimize patient care and the families you each serve. It is important to acknowledge the impact of dysphagia across the lifespan, life-long continued education and pursuit of evidenced-based practice as being pivotal in working at the top of our professional practice and licensure.

Respectfully submitted,
Donna Edwards, M.A., CCC-SLP, BCS-S
ASHA Fellow
OSLHA Fellow
Oropharyngeal Strengthening for Swallowing Rehabilitation

Jacqueline Hind

Abstract
Oropharyngeal strengthening for dysphagia rehabilitation continues to be of current interest and is supported by a growing body of evidence regarding reduction of aspiration and frequency of related hospitalizations. Technological pursuits are of importance in quantifying therapeutic interventions for best patient care and providing clinicians with objective data.

Learning Objectives
1) Describe the principles of oropharyngeal strength training.
2) Define an oropharyngeal strength training protocol.
3) Summarize pertinent published evidence supporting oropharyngeal strengthening.

Swallowing disorders, known as dysphagia, are associated with increased mortality and morbidity, including malnutrition, dehydration, pulmonary complications, and reduced quality of life. It is estimated that 22% of adults above the age of 50 and 55% of those within institutional settings suffer from dysphagia (Cabre et al., 2014). Numerous studies have demonstrated the higher incidence of pneumonia in patients with dysphagia, with up to a 7-fold increased risk in patients known to aspirate (Cabre et al., 2014; Gordon, Hewer, & Wade, 1987; Holas, DePippo, & Reding, 1994; Mann, Hankey, & Cameron, 1999; Schmidt, Holas, Halvorson, & Reding, 1994; Smithard et al., 1997). Pneumonia is the most common cause of infectious death for persons over 85 (LaCroix, Lipson, Miles, & White, 1989). Rates of hospital discharge for Medicare beneficiaries with aspiration pneumonia as a primary diagnosis have risen by 93.5% in the last two decades (Baine, Yu, & Summe, 2001); the length of hospital stay and death rates have also increased (LaCroix et al., 1989). Annual healthcare costs of treating pneumonia in elders is $4.4 billion; further, the illness is responsible for 4.5 million visits to Emergency Rooms, hospitals, and clinics annually (Marik & Kaplan, 2003). With an average hospitalization cost of $17,000, treatment of aspiration pneumonia has an estimated annual cost of $9.3 billion (Chen et al., 2010; Cichero & Altman, 2012).

Healthy Aging and Swallowing
The speed and strength of swallowing gradually decline after age 45 with approximately 22% of individuals over 50 having some symptoms of dysphagia (Cabre et al., 2014). Age-associated decline in skeletal muscle strength has been linked to age-related muscle atrophy (sarcopenia), and is typical of individuals over age 60 (Evans, 1995). Researchers have demonstrated the relationship between sarcopenia and age-related changes in lingual pressure generation: older, healthy individuals exhibited significantly reduced isometric tongue pressures compared to younger individuals (Buehring et al., 2013; Robbins, Levine, Wood, Roecker, & Luschei, 1995). These findings suggest a decrease in available “lingual pressure reserve” which accompanies even healthy aging (See Figure 1). Additionally, poor tongue-driving force is significantly associated with aspiration in frail elders with multiple comorbidities (Steele & Cichero, 2014). A study of older adults showed that a loss of skeletal muscle volume/strength (prevalence of ~77%) negatively impacts the ability to swallow safely (prevalence of ~30%) (Maeda & Akagi, 2016). Given that the lingual muscles provide the primary pump for moving food, liquid, and medication safely through the oropharynx and contribute to airway protection, this decline in pressure generation and...
pressure reserve means that older individuals are at increased risk for developing dysphagia, particularly when this age-related pressure decline is exacerbated by acute or chronic medical conditions.

A systematic review of physiologic factors associated with aspiration risk reported that both maximum isometric tongue– palate pressures and swallowing

![Figure 1. Maximum Pressures Generated Against the Tongue](image)

Note: As individuals age, maximum pressures generated by the tongue against the hard palate decrease while pressures generated during swallowing remain relatively unchanged. Individuals can become dysphagic when they are unable to generate enough pressure (even with maximum effort) to swallow safely (denoted by the arrow).

tongue pressures measured at the anterior and posterior palate are significantly reduced in those who aspirate compared to those who do not aspirate (Steele & Cichero, 2014). Additionally, poor tongue driving force is significantly associated with aspiration in frail elders with multiple comorbidities (Steele & Cichero, 2014). Given the decline in lingual strength both with age and age-related diseases, strengthening of the oropharyngeal musculature is a logical therapeutic option with growing evidence supporting its use.

Oropharyngeal strengthening – Overview

Strengthening oropharyngeal muscles is similar to strengthening other skeletal muscles in the body (Robbins et al., 2008). Burkhead and colleagues have published an excellent review of the principles of strength training (Burkhead, Sapienza, & Rosenbek, 2007). A broad overview is presented here:

- **Resistive Load**: must exceed usual levels of activity; pressure targets that are a percentage of the maximum (60-80%); must be progressively adjusted
- **Repetition**: the number of times an individual performs a task; inverse relationship between intensity and repetitions
- **Frequency**: how often a patient completes the prescribed tasks. In the limb musculature, strength training on the same muscle groups every day is considered less beneficial than every other day because the muscles require a day to recover and build. There is debate on whether this is true for the oropharyngeal musculature because there are some unique muscle fiber types in oropharyngeal musculature that are not found in other human skeletal muscles and thus may respond differently to strengthening regimens (Burkhead et al., 2007).
- **Specificity**: muscles or systems involved in a workout will be the ones to experience training

A typical oropharyngeal strengthening regimen includes: 10 press repetitions, 3x/day on 3 days per week for 2-12 weeks (Robbins et al., 2007; Rogus-Pulina et al., 2016). In an outpatient or home health environment, patients are loaned or rent a device to use at home to facilitate oropharyngeal strengthening. They then return to the clinic every week or two so that their clinician can adjust the protocol to maintain the challenge (see Resistive Load above). Individuals in residential settings such as skilled nursing environments each have their own oral sensor and then can share a single device directed by the therapist.

Oropharyngeal strengthening – Healthy adults

Oropharyngeal strengthening for dysphagia was first researched with healthy elders. An 8-week oropharyngeal strengthening program was completed with healthy elders age 70–89 years (Robbins et al., 2005). All participants significantly increased their isometric (p=0.001) and swallowing pressures for 10-ml thin liquid boluses (p=0.04) (Figure 2). Clark and colleagues studied 39 healthy adults (mean age: 38 years) who completed three types of isometric lingual strengthening regimens: lingual elevation, protrusion and lateralization (Clark, O’Brien, Calleja, & Corrie, 2009). Subjects completed 30 repetitions of a 1-second tongue push every day for 9 weeks. A portion of the
subjects (n=29) completed the three regimens sequentially (3 weeks of lingual elevation followed by 3 weeks of lingual protrusion and 3 weeks of lingual lateralization exercises), while the remaining subjects (n=10) were directed to complete the regimens concurrently (one set of 10 repetitions of each exercise daily). All three lingual strengthening regimens significantly increased strength, although the lingual elevation press generated a greater increase than the protrusion or lateralization regimen. In summary, findings with healthy adults laid the groundwork to show that lingual strengthening may be promising not only for preventing dysphagia due to sarcopenia, but also as a treatment strategy for patients with lingual weakness and swallowing disability.

Figure 2. Swallowing pressure changes after 8-weeks of progressive isometric lingual exercises (Robbins et al., 2005)

Linguinal strengthening – Dysphagia
The next logical application of oropharyngeal strengthening was focused on individuals with dysphagia. Device-facilitated oropharyngeal strengthening was first developed in the mid-1990’s allowing for quantification of pressures (Robbins, Levine, Wood, Roecker, & Luschei, 1995). Several studies are highlighted here; however, this is not an exhaustive list of this growing and robust area of research. Of obvious omission is the use of oropharyngeal strengthening with the head and neck cancer (HNC) population. Strengthening before, during and after treatment for HNC has been shown to improve swallowing safety and decrease g-tube dependence (Hutcheson et al., 2013; Rogus-Pulia et al., 2016), but given the complexity of this population, will not be discussed further due to space limitations.

One of the earliest published studies (Robbins et al., 2007) using oropharyngeal strengthening for dysphagia rehabilitation was with post-stroke patients. Ten patients with acute and chronic stroke completed oropharyngeal strengthening therapy by performing 10 press repetitions with the anterior tongue followed by 10 press repetitions with the posterior tongue, 3 times a day, 3 times per week consistent with recommendations for strength training by the American College of Sports Medicine (American College of Sports Medicine position stand, 1990). As the patients became stronger, therapy targets were adjusted every two weeks to reflect 80% of their maximum lingual press value. Patients demonstrated statistically significant improvements in isometric tongue strength (p<0.001) as well as pressures generated by the tongue during the act of swallowing 3-ml boluses (p=0.004), indicating carryover into functional activity (Robbins et al., 2007). The most clinically relevant results were reflected in the Penetration-Aspiration Scale (PAS) scores (Robbins, Coyle, Roecker, Rosenbek, & Wood, 1999; Rosenbek, Robbins, Roecker, Coyle, & Wood, 1996). PAS scores were significantly reduced, indicating increased swallowing safety for 3-ml thin liquid boluses after only four weeks of strengthening (p=0.005). After eight weeks of treatment, the PAS scores for both the acute and chronic stroke patients were significantly reduced for 10-ml thin liquid boluses (p=0.003) (Figure 3).

A randomized controlled study by Steele and colleagues (2016) included 14 participants (49 - 89 years) with dysphagia secondary to stroke (4-20 weeks) from three stroke rehabilitation centers. Participants were randomly assigned to Group 1: device-facilitated tongue-pressure profile training which emphasized pressure timing patterns or Group 2: device-facilitated tongue pressure strength and accuracy training. Both groups demonstrated increased tongue strength (p<0.001) and decreased oropharyngeal residue (p=0.05). No significant differences were noted between treatment groups indicating that both device-facilitated oropharyngeal rehabilitation protocols were effective.

One of the first studies to follow patients long-term after oropharyngeal strengthening was completed by Rogus-Pulia and colleagues (2016) in the Department of Veterans Affairs. Fifty-six veterans (41 - 96 years) with...
dysphagia from a variety of etiologies completed eight weeks of device-assisted oropharyngeal strengthening. In addition to short-term objective outcomes (penetration/aspiration scale, lingual pressures, diet, quality of life), participants were followed for 6-17 months after enrollment for comparison of pneumonia incidence and hospitalizations with the same period prior to enrollment. Significant improvements were noted with lingual pressures (p<0.001), diet (p=0.02) and quality of life (p<0.04). The number of hospital admissions decreased 61% significantly (p=0.009) with a 67% decrease in pneumonia diagnoses (p=0.10). Based upon actual hospitalization costs, the study authors reported a net cost savings of $734,862.

While effective, oropharyngeal strengthening is but one treatment approach in speech pathologists’ clinical toolbox. Malandraki and colleagues (2016) at Purdue University are incorporating oropharyngeal strengthening into a broader protocol termed Intensive Dysphagia Rehabilitation (IDR). IDR includes a combination of two oropharyngeal regimens (lingual strengthening, pharyngeal strengthening, base of tongue range of motion, or hyolaryngeal complex range of motion and strengthening), a targeted swallowing routine using salient stimuli, (i.e., favorite food) and caregiver participation. In a study of 10 participants (50 - 79 years) with adult onset neurogenic dysphagia (Malandraki et al., 2016), who completed a 4-week IDR protocol significant outcomes (Figure 3) found improved swallowing safety (decreased penetration/aspiration scores p< 0.005); reduced oropharyngeal residue (p<0.02) and improved quality of life (p<0.00). Of the five patients who were feeding tube dependent at baseline, two progressed to total oral nutrition, and two progressed to partial oral nutrition. Dr. Malandraki and her team are representative of true integration of evidence-based therapies with a patient-centered approach involving the patients’ desires as well as recognizing the importance of caregiver support.

Adherence
Therapy will only be useful if patients actually engage in the treatment plan. In a retrospective cohort study of 140 patients who had videofluoroscopic studies over an 18-month time span, 86 patients survived while 54 subsequently died (Low, Wyles, Wilkinson, & Sainsbury, 2001). Those who did not adhere to therapy recommendations had a greater number of hospital admissions due to chest infections or aspiration pneumonia (22% vs. 1.5%; p < 0.001). Aspiration pneumonia was recorded as a definite or probable cause of death in 26 (52%) of the 50 subjects who died.

![Figure 3. Changes in Penetration/Aspiration Scale Scores after 8-weeks of isometric lingual exercises](image)

Technology to objectively monitor and report adherence with therapy recommendations is becoming more common. Garber, Nau, Erickson, Aikens and Lawrence (2004), who compared types of self-report with electronic measures in medication management, found that only 17% of self-reports were “highly concordant” with the electronic measure. Of most relevance to dysphagia management was their finding that interview-based self-report was the least concordant and that questionnaires and diaries had higher concordance with electronic data (Garber et al., 2004).

Technology to Facilitate Oropharyngeal Strengthening
For decades, speech-language pathologists (SLPs) were armed with little more than a tongue depressor to facilitate oropharyngeal strengthening. They had to subjectively identify weakness, motivate patients with verbal encouragement alone and assess success in the broadest of non-quantitative measures. Devices such as the SwallowSTRONG System (Swallow Solutions, 2017) and the Iowa Oral Performance Instrument (IOPi Medical, 2018) have provided patients with objective feedback on performance and quantitative results of lingual pressure generation.
In conclusion, oropharyngeal strengthening for dysphagia rehabilitation has a growing body of evidence supporting its use; decreasing aspiration and reducing the frequency of associated hospital stays. In addition to improved patient care, technology to facilitate and quantify this therapeutic intervention is providing clinicians with the objective data required for progress reporting.

Author Contact
Jacqueline Hind, MS/CCC-SLP, BCS-S
Jahind66@gmail.com

References


Through Thick and Thin:
Clinical Perspectives on Consistency Modification

Brent Archer and Emily Russell

Abstract
Speech-language pathologists (SLPs) who provide services to adults with dysphagia routinely recommend that their clients consume altered consistency foods and liquids. This tutorial will briefly review the basic terms and concepts that underpin this intervention, provide an overview of the scientific literature related to studies of swallowing and its pathologies and show that the consensus view supports the use of consistency modification as a treatment option for some adults with dysphagia.

Brent Archer, Ph.D., CCC-SLP is employed by Bowling Green State University.
Financial – Is an Assistant Professor in Communication Disorders and Sciences at Bowling Green State University. His research interests include aphasiology, bilingualism in clinical populations and cognitive communicative disorders.
Nonfinancial – No relevant nonfinancial relationship to disclose.
Emily J. Russell, M.A., CCC-SLP is a doctoral student at Bowling Green State University.
Financial – Nothing to disclose.
Nonfinancial – Nothing to disclose.

Learning Objectives
1) Describe the dietary modifications prescribed for people with dysphagia.
2) Analyze the clinical utility and risks of consistency modification.
3) List methods for ameliorating risks associated with consistency modification.

Speech-language pathologists (SLPs) who treat dysphagia will often recommend that clients restrict oral intake to foods and liquids of certain consistencies. Specifically, therapists typically prescribe liquids that have been thickened to some degree. Solid intake is restricted to foods that require less chewing (e.g. naturally softer foods or purees are both options that may be suggested). The most commonly employed approaches to liquid and solid alteration are discussed below. The evidence in support of each kind of diet restriction is then reviewed.

A number of systems for codifying liquid consistency modification exist. Two of the most prevalent are the National Dysphagia Diet (National Dysphagia Diet Taskforce; 2002), developed by the American Dietetic Association, and the International Dysphagia Diet (IDD), developed by the International Dysphagia Diet Standardization Initiative (IDDSI; 2018). Under the NDD system, thickness is equated with viscosity, or the degree to which a liquid resists flow. The unit used to measure viscosity is centipoise (cP). The cP ratings of the three most commonly employed thickness levels are as follows: thin= 1-50 cP; nectar-like = 51-350 cP, honey-like = 351-1750 cP and spoon-thick >1750 cP (National Dysphagia Task Force, 2002). Under the IDD system, thickness is measured via a flow test. A 10 milliliter (ml) Luer tip syringe is filled with the sample and the amount of fluid that flows out in 10 seconds is measured. Thin liquids will flow at a rate of 9 ml/10 seconds, slightly thick liquids at 9-7 ml/10 seconds, mildly thick at 3-7 ml/seconds and moderately thick at 0-3 ml/10 seconds (IDDSI, 2018). Extremely thick liquids are measured by means of a test that is also used for solids (IDDSI, 2018).
Various state agencies use these definitions to produce guidelines that are more user friendly. For example, the Diet Manual of the California Health and Human Services Agency specifies that nectar thickened liquids coat spoons and fall in small droplets (State of California Health and Human Services Agency, 2010). Honey thickened liquids coat spoons and fall in small clumps (State of California Health and Human Services Agency, 2010). Spoon thickened liquids coat spoons and fall in large clumps (State of California Health and Human Services Agency, 2010). The Indiana Family and Social Services Administration Division of Disability and Rehabilitative Services Bureau of Quality Improvement Services (2009) stipulates that nectar-like fluids are thin enough to be sipped through a straw or from a cup, but thick enough to fall off a tipped spoon slowly. Honey-like fluids can be eaten with a spoon or sipped from a cup and are too thick to sip from a straw (Indiana Family & Social Services Administration Division of Disability & Rehabilitative Services Bureau of Quality Improvement Services, 2009). Pudding-like (spoon thick) fluids must be eaten with a spoon and hold their shape on the spoon (Indiana Family & Social Services Administration Division of Disability & Rehabilitative Services Bureau of Quality Improvement Services, 2009).

A number of reviews and publications have questioned the assumption that restricting liquid intake to thickened fluids increases swallow safety (Foley, Teasell, Salter, Kruger, & Martino, 2008; Loeb, Becker, Eady, & Walker-Dilks, 2003; Miller et al., 2010). Though many authors have called for further, well-designed efficacy studies investigating the benefits of thickening liquids (Barbon & Steele, 2015; Geeganage, Beavan, Ellender, & Bath, 2012; Hines, Kynoch, & Munday, 2013; Hyland, 2013; Steele et al., 2015), some evidence exists that thickened liquids may reduce aspiration (Barbon & Steele, 2015; Speyer, Bajens, Heijnen, & Zwijnenberg, 2010; Steele et al., 2015; Teasell, Hussein, Foley, & Cotoi, 2015). The benefits of thickening are particularly evident for clients who have difficulties controlling the direction of the stream or clearing liquids from the mouth (Germain, Dufresne, & Ramaswamy, 2006). The client populations who display reduced risk of aspiration when provided with thickened liquids include stroke survivors (Andersen, Beck, Kjaersgaard, Hansen, & Poulsen, 2013; Geeganage et al., 2012; Teasell et al., 2015), people with dementia-related swallowing difficulties (Alagiakrishnan, Bhanji, & Kurian, 2013; Andersen et al., 2013), head and neck cancer patients (Barbon & Steele, 2015), patients with Parkinson’s disease (Andersen et al., 2013) and patients with chronic obstructive pulmonary or chronic respiratory disease (McKinstry, Tranter, & Sweeney, 2010).

Taxonomies for describing various solid food options have been delineated. Under the NDD, ‘regular’ foods are foods that have not been modified (National Dysphagia Task Force, 2002). Clients placed on ‘level 3’ diets can consume solid foods that naturally require some (but not excessive) chewing (National Dysphagia Task Force, 2002). ‘Level 2’ diets consist of foods that are altered in some way such that they are cohesive, moist and semi-solid and require very little chewing (National Dysphagia Task Force, 2002). ‘Level 1’ is characterized by foods that have been reduced to a homogenous, cohesive mass that requires no chewing (National Dysphagia Task Force, 2002). Similarly, the IDDSI (2018) classifies solid foods into five categories. ‘Regular’ foods are normal everyday foods. ‘Soft and bite sized’ foods can be mashed with a fork or spoon and are soft, tender and moist throughout. ‘Minced and moist’ can be eaten with a fork or spoon and will retain a ball shape. ‘Pureed’ foods require no chewing. Further, foods at this level show some very slow movement under the effect of gravity but cannot be poured (more comprehensive definitions are available at iddssi.org).

The sites and settings where SLPs are employed may use the above terminology to describe the consistency alteration interventions available. Alternatively, professionals may elect to use a different set of terms to describe levels that broadly align with those outlined. For example, many sites designate foods that would be appropriate for level 2 as ‘mechanically soft’ and level 1 is commonly termed ‘pureed’ (McCullough, Pelletier, & Steele, 2003).

While the evidence base supporting the therapeutic value of modified consistency solid foods is not yet as extensive as that related to thickened liquids, several studies and reviews provide preliminary evidence that modifying solid food promotes safe swallowing in certain clients with dysphagia (Carnaby, Hankey, & Pizzi, 2006; Garcia & Chambers, 2010; Geeganage et al., 2012;
Rothenberg et al., 2007; Speyer et al., 2010). Moreover, the clinical consensus, as expressed by professional speech-language pathology organizations in Scotland (Scottish Intercollegiate Guidelines Network, 2010), New Zealand (Stroke Foundation of New Zealand, & New Zealand Guidelines Group, 2010) and the United Kingdom (Royal College of Physicians, 2012) view altered consistency solid foods as a defensible component of treatment regimens when providing services to people with dysphagia. Mechanically altering foods is thought to be a valuable strategy for increasing swallow safety for clients who have difficulties with chewing, bolus formation, bolus control and clearing the oral cavity after meals (Penman & Thomson, 1998).

Risks associated with consistency modification
Several studies have highlighted possible links between thickened liquids and negative health outcomes in clients with dysphagia. In a large scale, randomized control study which compared a range of health outcomes in participants who aspirated thin liquids, participants were placed in chin tuck maneuver, nectar and honey thick groups (Robbins et al., 2008). The authors found that participants placed in the honey-thick group were twice as likely to develop pneumonia than those in the nectar-thick group; thereby providing preliminary evidence of a connection between drinking honey thickened liquids and pneumonia. Furthermore, the authors found that clients whose liquid intake was restricted to honey thickened fluids also spent more time in hospital recovering from pneumonia. Additionally, placing clients on a honey/nectar diet appears to increase the risk that they will develop urinary tract infections (Murray, Doeltgen, Miller, & Scholten, 2016) or become dehydrated (Finestone, Foley, Woodbury, & Greene-Finestone, 2001; Murray, Miller, Doeltgen, & Scholten, 2014; Whelan, 2001) which can in turn lead to a range of complications such as poor wound healing, infections, constipation, urinary tract infections (UTIs), altered cardiac function or acute renal failure (Archibald, 2006). My own clinical experience leads me to believe that inappropriate thickening may set up a vicious cycle: a client’s fluid intake is limited to nectar or honey thickened liquids; she becomes dehydrated as a result and subsequently develops a UTI; her cognitive function declines as a result; her ability to safely swallow is further compromised because of her confused mental state; the SLP treating her thus recommends that the restrictive diet continues; which perpetuates the state of dehydration, and so on.

Therefore, though liquid thickening may be beneficial for some clients, this approach to managing dysphagia may be associated with risks that SLPs should be aware of when deciding how best to manage swallowing disorder in a given client. Two precepts discussed in the dysphagia literature can help clinicians and clients develop treatment plans, which exploit the benefits of consistency modification while minimizing the potential risks outlined above.

First, SLPs should understand that while consistency modification is an accepted element of our practice, it should be prescribed in a limited range of instances. Unfortunately, the available data suggest that consistency modification is over-prescribed by SLPs. Groher and McKraig (1995) found, in a study of 212 nursing home residents suspected of having swallowing disorders, that 91% of participants were placed on diets that were more restrictive than those suggested by commonly accepted clinical guidelines. Similarly, studies by Garcia, Chambers, Clark, Helverson and Matta (2010) and Garcia, Chambers, and Molander (2005) have shown that SLPs and other professionals routinely over-thicken liquids provided to clients with dysphagia. As professionals, we should consider Tippet (2011) and Rogus-Pulia and Robbins’ (2013) contention that other treatments such as compensatory swallowing strategies and posture/position maneuvers should be attempted before a restricted diet is recommended. The notion that consistency modification should be viewed as a treatment of last resort is underscored by a large-scale randomized control study (Robbins et al., 2008) of participants with dysphagia who derived equal benefit from implementing the chin tuck maneuver and receiving thickened liquids. The authors found that no significant differences in various health outcomes could be discerned between the conditions, suggesting that in many cases, compensatory strategies offer the same degree of airway protection as consistency modification. Further, whenever possible, dietary restrictions should be implemented on a temporary basis until a given client’s swallowing abilities improve enough to warrant a diet upgrade. By reducing the overall number of clients whose intake is restricted to consistency modified foods, and by reducing the amount of time any given client spends on a restricted
diet, we can minimize the risks to which clients are exposed.

Second, decisions about how to treat dysphagia must be based on a thorough, ongoing, data-oriented assessment process. While bedside screenings and assessments of swallowing are valuable methods for identifying people with dysphagia (Brodsky et al., 2016; Romano, Schultz, & Tai, 2012; Westergren, 2006), videofluoroscopic modified barium swallow studies (VMBSS) are considered the gold standard for in-depth diagnostic analysis (Catalan Agency for Health Technology Assessment and Research., 2007; Oertel et al., 2011; Royal College of Physicians, 2012; Russi et al., 2012; Teasell et al., 2015). Aside from confirming the presence of aspiration, VMBSS should investigate the physiological causes of swallowing dysfunction (Winstein et al., 2016), and furnish clinicians with information about how clients respond to different treatment options (e.g. compensatory strategies, consistency modification) (American College of Radiology, 2014; Hammond & Goldstein, 2006; Logemann et al., 2008; Scottish Intercollegiate Guidelines Network, 2013; Veteran’s Health Administration, & Department of Defense, 2010). Conducting a treatment-oriented assessment will empower clinicians and clients to make better-informed, systematic choices about how a given client’s diet should be modified, and will allow stakeholders to form an informed opinion which balances the risks and benefits of consistency modification. Assessments should be conducted regularly to determine if current dietary levels are appropriate for a given client’s clinical profile (American Medical Director's Association, 2010; National Clinical Guideline Center, 2013; Veteran’s Health Administration, & Department of Defense, 2010).

Reconciling clinician and client perspectives on consistency modification
A mismatch exists between clinicians who understand the benefits of consistency modification and routinely recommend this option when treating dysphagia, and clients with dysphagia, who tend to demonstrate low rates of compliance with this treatment approach (Garcia et al., 2005). Widely accepted conceptualizations of evidence-based practice (EBP) argue that client values should inform clinical practice (McKibbon, 1998). If our profession is to pursue EBP in a meaningful way, its practitioners need to reconcile clinical recommendations and client perspectives.

One way in which professionals could make consistency modification more palatable to clients is to find methods of altering diets that align more closely with our natural human eating preferences. Many clients may reject modified diets because the foods offered to them resemble “baby food” (Hotaling, 1992). Several strategies for avoiding this pitfall have been suggested. SLPs and the relevant dietary professionals can work together to implement programs which focus on presenting thickened drinks and pureed foods in more natural and appetizing ways. Elements of such a “cuisine puree” (Hotaling, 1992) menu might include pureed foods that are molded to resemble the solid food items from which they are derived (Stahlman, Garcia, Hakel, & Chambers, 2000; Stahlman, et al., 2001). Adopting the trappings and atmosphere cultivated in restaurants may also make eating more enjoyable (Hotaling, 1992). Another more acceptable (from the client’s perspective) approach to diet modification might be to develop a dietary plan featuring foods and drinks that naturally conform to the restrictions of a dysphagia treatment regimen. A recent study by Archer and colleagues (2017) in which five SLPs voluntarily placed themselves on a nectar thick-pureed solids diet for a week showed that it is possible to remain within the confines of these restrictions while still eating and drinking foods that have not been artificially modified; foods such as hummus, vichyssoise soup, creamed spinach and pudding can be prepared such that they are equivalent to purees while drinks such as tomato juice, smoothies and Guinness Irish stout are as viscose as nectar thick liquids. Finally, molecular gastronomy provides a wealth of techniques and resources that can be used to produce foods that are safe for people with dysphagia to eat while minimizing changes to flavor and texture (Reilly, Frankel, & Edelstein, 2013).

Another component of clinical practice that may increase client willingness to restrict consumption to consistency modified foods is the free water protocol. As detailed by Panther (2005), a free water protocol allows certain clients to consume as much clean, thin water as they wish. Crucially, to be included in a program of this sort clients should be in the sub-acute stage of recovery from major medical events (Karagiannis, Chivers, & Karagiannis, 2011), preferably be independently mobile (Karagiannis & Karagiannis, 2014), have enough cognitive ability to understand when water can be drunk safely (Gillman, Winkler, &
Taylor, 2016) and receive support in maintaining meticulous oral health (Bronson-Lowe et al., 2008). If clients are appropriate for admission to a free water program, their risk of developing pneumonia is no greater than people whose intake is restricted to thickened liquids (Frey & Ramsberger, 2011; Garon, Engle, & Ormiston, 1997; Gillman et al., 2016) since the aspiration of clean, pathogen free water rarely leads to adverse effects (Effros et al., 1997). While the evidence that free water protocols help to reduce dehydration is weak (Gillman et al., 2016), participants in studies investigating this approach strongly indicate their preference for having access to thin water (Garon et al., 1997) and that participation in a free water protocol positively effects various aspects of quality of life (Gillman et al., 2016; Karagiannis & Karagiannis, 2014; Karagiannis et al., 2011). Moreover, since thickeners may decrease the sensation of thirst reduction that accompany drinking (Cichero, 2013), supplementing modified drinks with regular water may reduce the feelings of thirst that clients often report. Given the many psychological and physical benefits that clients seem to derive from a free water protocol, they may be more willing to forego the usual enjoyment that they derive from consuming unaltered foods and drinks if they are simultaneously permitted access to as much thin water as they desire.

Conclusion
Providing services to people with dysphagia often involves a balancing act, in that the team (SLP, associated professionals, clients and their families) must attempt to ensure that short-term clinical needs are met while at the same time minimizing the risks clients are exposed to. Consistency modification can be an integral part of the services we deliver to people with dysphagia. However, this approach to treatment entails a certain amount of risk and is not a ‘one size fits all’ solution. When determining whether to place a client on an altered diet, knowledge of the potential negative outcomes associated with this treatment strategy and the client’s physiological swallow deficits allows clinicians and their clients to make a more informed decision. Further, an understanding of how to make this treatment more acceptable to clients will help to increase compliance rates. ♦

Author Contact
Brent Archer Ph.D.
barcher@bgsu.edu

References


Romano, M., Schultz, T., & Tai, A. (2012). The diagnostic test accuracy of clinical swallow assessment for oropharyngeal aspiration: A systematic review. JBI Database of Systematic Reviews and Implementation Reports, 10(56), 1-16.


A Case of Lance-Adams Syndrome: The Clinical Process of the Evidence-Based Clinician

Annette Askren and Paula Leslie

Abstract
Evidence-based practice (EBP) has become a hallmark of modern medicine. Diving into the literature is an essential part of clinical decision-making. The management of rare disorders and disease almost always prompts a search, but the answers to important clinical questions can be challenging and rarely straightforward. The majority of us have endured the “EBP Class” of our academic careers, drilling the hierarchy of research evidence and whether strict inclusion/exclusion criteria were considered, etc. We frequently see our medical colleagues turn to high powered trials and meta-analyses, but such works are few and far between. Single-subject design, case studies, case series, and reviews of such cannot be discredited, especially within a profession that is relatively new in the broad scheme of medicine. The following case study details a clinician’s process through the identification, appraisal, and application of relevant literature in the management of a rare disorder: Lance-Adams syndrome. Proposed assessment considerations are intended to help the reader’s approach to diagnosis and intervention.

Learning Objectives

1) Define Lance-Adams Syndrome and identify its associated communication and swallowing impairments.
2) State the roles of the interdisciplinary team appropriate for individuals with Lance-Adams Syndrome.
3) Summarize appropriate diagnostic considerations for swallowing and communication difficulties in individuals with Lance-Adams Syndrome.

A 33-year-old male with newly diagnosed Lance-Adams syndrome (LAS) was referred to the speech-language pathology service to address communication and swallowing. The patient was admitted to a teaching hospital after being stabilized at an outside facility following heroin overdose. During the overdose, the patient went into cardiac arrest, and his spouse started cardio-pulmonary resuscitation. The patient was transported by ambulance to his community hospital where he remained unconscious and intubated with mechanical ventilation for four days. Continuous electroencephalography suggested status epilepticus. The patient was transferred to the teaching hospital two weeks thereafter. Following the transfer, he was awake and alert and resumed a regular-textured oral diet, ordered by the medical team.

Records to this point were scattered. It was not until the patient was admitted to the teaching facility that clinical features consistent with LAS were observed. A chest radiograph revealed atelectasis, or reduced lung inflation, of the right lower lobe and developing pneumonia. Repeated radiograph one month later was normal. Repeated head imaging was also normal. The patient told his medical team that he was having trouble feeding himself and “getting [his] words out”, prompting our referral.

The patient had a history of hepatitis C virus, substance abuse disorder (including alcohol), post-traumatic stress disorder, anxiety, depression, and tinnitus. The patient served four years in the United States Air Force after graduating from high school and was currently unemployed. He had four children and was living with his spouse prior to admission. The patient described his relationship as “rocky”.
Inpatient medications included clonazepam, a benzodiazepine, and valproic acid, an antiepileptic drug. Both were prescribed to treat the myoclonic dyskinesia described later. Mirtazapine, an atypical antidepressant, and sertraline, a selective serotonin reuptake inhibitor, were both used to treat depression and generalized anxiety disorder (off-label). Clonidine was prescribed (off-label) to address opioid withdrawal. Heparin was prescribed as an anticoagulant. Thiamine was used to prophylactically treat thiamine-deficiency in the context of a known history of alcohol abuse.

Supporting Research Evidence
A search for best available evidence led to the databases PubMed, Google Scholar, and ASHA Wire. Combinations of relevant search terms were used: Lance-Adams syndrome, speech, swallowing, cognition, language, post hypoxic myoclonus, hyperkinetic, patient reported outcome. The search returned a series of case studies and systematic reviews. The following describes those deemed most pertinent to the case under discussion.

LAS was first described in 1963 (Lance & Adams, 1963). Four patients sustained anoxic encephalopathy following either cardiac arrest or a prolonged airway obstruction. Similar disturbances in movement were observed amongst the patients after regaining consciousness. Volitional movement induced an arrhythmic course or fine jerking of a single or group of muscles. Movements were approximately one-fifth of a second in duration and labeled action or intention myoclonus. Voluntary motion was initiated well, but became quickly interrupted. Movement became increasingly chaotic and fragmented as it continued. Severity of the myoclonus was found to be grossly proportional to the precision of the task. Lance and Adams (1963) described the relevant examples of “conveying food to the mouth” and “drinking from a glass” (p. 117) as particularly difficult activities. Myoclonic movements ceased when patients relaxed. All four patients consistently maintained an ataxic gait.

Lance and Adams (1963) hypothesized that the underlying neuropathophysiology included a repetitive firing of thalamocortical fibers, stemming from the ventrolateral thalamic nucleus. The ventrolateral thalamic nucleus plays a large role in mediating motor function. This area receives input from both the cerebellum and basal ganglia and projects to the primary motor and premotor cortices (Siegel & Sapru, 2015). Abnormal firings through these projections are relayed to the corticobulbar and corticospinal tracts, producing action myoclonus (Duffy, 2013). Autopsies from Lance and Adams’s other deceased patients revealed that the globus pallidus, hippocampus, deep folia of the cerebellum, and deep layers of the cerebral cortex were structurally damaged by similar anoxic brain injuries. These areas, as well as the Purkinje cells of the cerebellum, were hypothesized to be damaged in LAS specifically.

Lance and Adams’s (1963) paper is certainly dated, but they provide a descriptive review. Their description continues to be referenced as a standard definition of the syndrome in the most recent literature. The four patients that are described closely resemble the current case, making this evidence pertinent to diagnostic considerations.

Gupta and Caviness (2016) conducted the most recent systematic review of the LAS literature. The authors concluded that the neuropathophysiology and the neuroanatomy implicated remains poorly understood. Imaging studies collectively identified a wide variety of damaged neuroanatomy, including the basal ganglia, parietal lobes, and hippocampus. Some findings were even transient, resolving after repeating their imaging studies weeks later. Seizures were often observed in the acute comatose stage following a hypoxic event. Onset of LAS symptoms was observed days to weeks thereafter. LAS was found to be associated with dysarthria, dysphagia, seizures, cognitive deficits, and gait disturbances. Unfortunately, these impairments of significant interest to the speech-language pathologist were not well described. The collective literature indicated LAS responded well to benzodiazepines and anticonvulsant drugs. The syndrome typically persisted indefinitely.

Lee and Lee (2011) published a case report describing a patient strikingly similar to the current case. A 32-year-old male went into cardiac arrest after attempting to hang himself. He was successfully resuscitated and transferred to his community hospital. Computed tomography of the head was normal. Electroencephalography revealed status epilepticus. On day-12 of his hospitalization the patient regained consciousness, but he displayed action myoclonus. Performance on the Mini-Mental State Examination...
occurrence with longer utterances. Errors would be highly variable and increase in proportionally worse myoclonic jerking. By discharge, the patient was able to walk 20 meters with the assistance of a rolling walker. His dysarthria persisted.

### Possible Impairments
Understanding the basic underlying nature of LAS and its known consequences can guide the evidence-based clinician. The case history and review of relevant external evidence suggests diagnostic hypotheses implicating oropharyngeal swallowing, motor speech, and cognitive-communication.

### Swallowing
The literature identified action myoclonus, a dyskinesia, as the primary feature of LAS. Dyskinesias, like those in LAS, may result in dyscoordination of the oropharyngeal swallow (Stierwalt, 2013). The muscle relaxant and sedative properties of the benzodiazepine (clonazepam) and anticonvulsant (valproic acid) could contribute to both dyscoordination and inattention. Atypical antidepressants (mirtazapine) may also cause sedation. Side effects are often amplified in the setting of liver dysfunction (Carl & Johnson, 2006). Lance and Adams (1963) described relatively fine motor movement resulting in proportionally worse myoclonic jerking. The ability to self-feed would be impacted.

### Speech
Motor speech impairment is very likely to be observed, specifically hyperkinetic dysarthria. Experts suggest dysarthria associated with action myoclonus may have a greater functional effect on speech production, as compared to the more familiar palatopharyngeal myoclonus (Duffy, 2013). Aronson, O’Neill, and Kelly described their own four cases of LAS (as cited in Duffy, 2013). Their patients demonstrated fluctuations in phonation, and the aberrant phonatory function synced with action myoclonic movement of the lips. Sudden voice arrests, generally slow rate of speech, and articulatory imprecision when rate increased would therefore likely be observed in the current case (Duffy, 2013). Errors would be highly variable and increase in occurrence with longer utterances.

### Cognitive-Communication
The etiology of LAS suggests cognitive-communication impairment should also be considered. Plans for intervention may be directly impacted by such findings. Studies sporadically implicated structures of the basal ganglia and cerebellum among other areas. Both the basal ganglia and cerebellum have been found to play a role in cognitive functioning (Middleton & Strick, 2000). A review of long-term consequences associated with hypoxic-ischemic encephalopathy indicated a range of severity of cognitive impairments has been observed (Khot & Tirshel, 2006). A reversible metabolic encephalopathy has been reported after relatively brief periods of circulatory arrest. This transient difficulty, characterized by a short period of confusion, or at least improvement in functioning, as described in the case by Lee and Lee (2011), may be expected in the current case.

### Conclusions: Diagnostic Considerations
The comprehensive speech-language pathology evaluation will vary amongst clinicians. The following points are intended to assist the evidence-based clinician shape the assessment plan in consideration of the literature.

Clinical examination of the oropharyngeal swallow is an essential start. The gross impact of the action myoclonus and medication effects on feeding and swallowing must be considered prior to a potentially complicated transport to a radiology suite (videofluoroscopic swallow study) or more invasive nasendoscopy (fiberoptic endoscopic evaluation of swallowing). Severe onset of jerking movements while eating and drinking may impede a clinician’s ability to capture a meaningful instrumental assessment. The clinical exam can also provide opportunity to trial optimal posturing and plans for feeding during an anticipated instrumental assessment. Medication changes may be made frequently, and clinical reassessment will be necessary.

Assessment of cognitive-communication skills should consider medication effects, medication changes, and the action myoclonus itself. As mentioned previously, many drugs have sedating effects and may directly contribute to inattention. Selection and administration of standardized measures must consider the difficulties that movement of the upper extremities pose (e.g., trail-making task).
An interdisciplinary approach will be essential to maximizing this patient’s outcomes. Referral to and close collaboration with allied rehabilitation providers should be of high priority. The American Speech-Language-Hearing Association supports our role as “Case Manager” in individuals with cognitive-communication impairments (ASHA, 2005). The speech-language pathologist may assist with establishing the team and the effective communication amongst the following essential members. Specific implications for the speech-language pathologist are proposed:

- **Physicians.** Close collaboration will clarify medication effects and changes. This may incorporate Pharmacists. Plans for the patient’s disposition, ordered by the physician, must consider all team members’ observations.

- **Occupational Therapists.** Adaptive feeding and writing devices will directly affect the speech-language pathologist’s assessments and interventions.

- **Physical Therapists.** Optimal positioning recommendations and management of action myoclonus of the upper extremities may improve ability to capture meaningful evaluations (e.g., videofluoroscopic swallow study).

- **Mental Health Team/Social Workers.** Establishing substance abuse treatment is essential to maximize long-term success. Counseling should consider the transition into a sudden, permanent disability and its effect on mental well-being.

**References**


Carl, L. L., & Johnson, P. R. (2006). *Drugs and Dysphagia: How medications can affect eating and swallowing*. Austin, TX: Pro-Ed.


Feeding the Infant with Cleft Lip and/or Palate: Tips for the First Year of Life

Lauren L. Madhoun

Abstract
Feeding difficulties are common for infants with cleft palate, particularly in early infancy (Greives et al., 2017; Jones, 1988). It is essential for clinicians treating these children to have appropriate understanding of the specific feeding needs of these babies. Furthermore, management relies upon close collaboration with a team of medical specialists to provide well-rounded care for best outcomes.

Lauren L. Madhoun, Ph.D., CCC-SLP, BCS-S is employed at Nationwide Children’s Hospital (Dayton, OH).
Financial – Is a speech-language pathologist and board-certified swallowing specialist. Is a member of the Nationwide Children’s Hospital Cleft Lip and Palate-Craniofacial Center Team.
Nonfinancial – Clinical work focuses on the assessment and treatment of children with dysphagia, specifically those with craniofacial anomalies. Research interest in feeding skills of infants with cleft palate.

Learning Objectives
1) Describe challenges related to feeding infants with cleft lip and/or palate.
2) Name bottles that may improve feeding success for infants with cleft palate.
3) State medical providers routinely involved in the care of infants with clefts.

Feeding difficulties are common for infants with cleft palate, particularly in early infancy (Greives et al., 2017; Jones, 1988). It is essential for clinicians treating these children to have appropriate understanding of the specific feeding needs of these babies. Furthermore, management relies upon close collaboration with a team of medical specialists to provide well-rounded care for best outcomes.

Cleft lip and/or palate affects one in every 940 births and is the second most common birth defect in the United States (Parker et al., 2010). Clefting occurs early in prenatal development when the tissues of the face and mouth do not fuse together properly (Marazita & Mooney, 2004). This can arise from many different causes. Some of the factors that increase the likelihood of clefting include maternal smoking or alcohol use in early pregnancy, a diagnosis of diabetes prior to becoming pregnant, and the use of some medications during the first trimester (DeRoo et al., 2016; Hunt et al., 2008; Jackson et al., 2016; Munger et al., 1996; Spilson et al., 2001; Xuan et al., 2016). A family history of cleft lip and/or palate is also linked to recurrence, which is why genetic consultation is essential for families. However, often a reason is unable to be found, implying that the cleft simply arose sporadically during early development.

Infants with a cleft lip and/or palate face many obstacles related to feeding based on the type and degree of clefting. These anatomical differences can jeopardize an infant’s ability to feed efficiently and effectively, possibly impacting nutritional intake and potentially delaying surgical intervention. Therefore, clinicians must be aware of the specialized techniques and cleft-specific bottles, which are used to address the feeding complexities in infants with cleft palate.
Furthermore, considerable education and training must be provided to the caregivers of these infants, as it is vital for their early growth and development.

Exclusive direct breastfeeding can be a challenge, if not impossible, for infants with cleft palate. This can be a difficult conversation for those mothers who desired and planned to feed at breast. When working with an infant who is breastfeeding, it is important to remember that success is often dependent upon the type of cleft present.
For infants with a cleft lip only, direct breastfeeding may be possible with proper positioning and supportive strategies such as filling the gap of the lip with the mother’s breast tissue or her finger (Clarren et al., 1987). Infants with cleft palate; however, have a decreased ability to create the necessary negative pressure to draw the liquids from the breast due to the opening between the mouth and the nose (Clarren et al., 1987; Mizuno et al., 2002; Reid et al., 2007). Therefore, it is often not possible for infants with a cleft palate to exclusively and directly breastfeed.

If necessary, supplemental feeds may benefit an infant with a cleft palate (Reilly et al., 2013). Given the known benefits of breast milk, supporting mothers in pumping and providing expressed milk via specialty feeding systems is encouraged for those infants who are unable to directly breastfeed (Alperovich et al., 2016; Reilly et al., 2013). Lactation consultants are often helpful to guide mothers in direct breastfeeding attempts and in strategies to promote pumping. Furthermore, protocols on breastfeeding infants with clefts have been established by the Academy of Breastfeeding Medicine and can guide clinical practice (Reilly et al., 2013).

**Bottle Feeding**

Similar to breastfeeding, infants with solely a cleft lip are often able to use standard bottle systems without difficulty. However, for those infants with a cleft palate, special feeding systems are required to ensure adequate and efficient delivery of milk due to their inability to create suction (Clarren et al., 1987; Mizuno et al., 2002; Reid et al., 2007). These bottles and nipples are often the first line management to ensure the infant is able to meet their nutrition and hydration requirements.

The feeding systems used for infants with cleft palate fit into two categories. The first relies on compression of the bottle or nipple, which is performed by the caregiver, in rhythm with the infant’s sucking to provide the milk to the infant (Miller, 2011). The second category of bottles is considered “infant-driven” and includes a one-way flow valve, which allows the baby to compress the nipple to expel the liquid. For these systems, the valve allows the milk to easily travel from the bottle to the nipple and into the infant’s mouth during feeding.

There are four feeding systems typically used for infants with cleft palate. These include the Mead Johnson Cleft Lip/ Palate Nurser™ (Mead Johnson Nutrition; Chicago, Illinois), Medela® SpecialNeeds™ Feeder (Medela LLC.; McHenry, Illinois), Pigeon™ Nipple/Bottle (Pigeon Corporation; Chuo-ku, Tokyo, Japan), and Dr. Brown’s Specialty Feeding System* (Handi-Craft Company; St. Louis, Missouri). The Mead Johnson Cleft Lip/ Palate Nurser™ and Medela® SpecialNeeds™ Feeder are considered assisted delivery systems and the Pigeon™ Nipple/Bottle and Dr. Brown’s Specialty Feeding System* are infant-directed.

It is important that the bottle chosen matches the infant’s feeding efforts and the caregiver’s preference. Close observation and monitoring is typically required for a few days or weeks when initiating or changing an infant’s feeding system to ensure establishment of an adequate routine. Appropriate education is required for all individuals who will be feeding the child in regard to bottle assembly and use. Demonstration and hands-on practice should be provided during the session and visuals, such as handouts or videos, provided for others who are not able to be present.

Due to the opening between the mouth and the nose, nasal regurgitation, or liquid coming out of the nose, is common in infants with unrepaird cleft palate during feeding and when the child spits up. Placing children in an upright posture during feeding and holding them in this position for 15-30 minutes following feeding may decrease the likelihood of nasal regurgitation.

Similar to infants without clefts, feeding times should be kept to 30 minutes or less. Furthermore, feeds should be provided at scheduled times, rather than just allowing the infant to “snack” on smaller volumes throughout the day. These are useful reminders for families and may be reinforced by having the caregivers record feeding times and durations with the use of a feeding log.

**Early Growth and Nutrition**

Feeding success is critical for all infants to ensure appropriate development. All infants are born with an excess of total body water due to the amniotic fluid surrounding them during gestation. Once an infant is born, they begin to lose this fluid, which results in a 5-10% weight loss for a term infant (Blackburn, 2013). However, with adequate nutrition and hydration, they
begin to regain this loss with the goal of returning to birth weight by 14 days of age. Some infants with clefts have difficulties returning to their birth weight, particularly those with cleft palate with or without cleft lip, and challenges with growth are well documented (Avedian & Ruberg, 1980; Cunningham et al., 1997; Felix-Schollaart et al., 1992; Jones, 1988; Kaye et al., 2017; Marques et al., 2009; Seth & McWilliams, 1988). Therefore, it is essential that appropriate feeding means be established early on and the medical team monitors feeding and weight gain closely. If necessary, additional services can be sought from a feeding specialist, lactation consultant, or a dietician to assist in these early feeding needs. This may involve interventions, such as changes to the feeding system, the volume of milk offered, or the caloric density of the milk (Kaye et al., 2017).

**Introduction of Solids**

Caregivers often report fears of introducing solids to infants with clefts due to potential of nasal regurgitation. The American Academy of Pediatrics currently recommends solid foods be initiated at 6 months of age, which is what is also recommended for infants with clefts (Section on Breastfeeding, 2012). Often thin purees are offered initially with gradual advancement to thicker and then more textured solids.

Standard feeding recommendations of having the infant in a supported seating system and offering small spoons of food when the infant shows signs of readiness are provided to families of infants with clefts. If nasal regurgitation is noted, caregivers are informed to continue feeding and gently wipe away any food residue. There is no need to use a syringe to clear the remaining food. Slightly thickening thin purees with infant cereal or using thicker purees sometimes improves the infant’s ability to transfer the bolus and may decrease nasal regurgitation. If the infant consistently becomes very irritable and upset with solid food feeding, caregivers should reach out to a trained feeding therapist to attempt other strategies.

After introducing purees, caregivers should be instructed to advance textures as developmentally appropriate. Some families hope to not initiate these types of foods until the cleft palate is repaired because they are afraid the infant will experience discomfort with feeding. Parents should be informed that no pain should result from this and that the introduction of these textures solids is very important. Since surgery is typically not performed until 10 to 12 months of age, there is concern that infants will become less accepting of textures as they age if there is a delay in offering them (Coulthard et al., 2009). Therefore, it is important for speech-language pathologists to support caregivers in offering these foods in structured therapy settings and then assist in carryover to home.

Caregivers should also be informed that some cleft teams restrict the type of solids and feeding utensils offered for a short period of time after surgical repair to ensure adequate healing. Self-feeding is also often discouraged and close monitoring is required to guarantee the child will not introduce anything into the mouth that could disrupt the surgical repair.

**Cup Drinking**

Families are often encouraged to also begin transitioning to a sip cup during the latter half of the first year. Due to their inability to create suction, infants with cleft palate often require certain types of cups or modifications to standard cups.

Some cups do not require suction, such as those that have a soft spout with a valve that opens by munching or biting. These are similar to the infant-driven bottle systems and may be a good cup to trial initially. There are also some spoutless cups that open by the pressure of the lip contacting the rim during drinking, which can be used without modification. Open cups and those without a valve can be used as well, but may be messy for infants learning to drink.

Cups with a valve will not allow the infant with an unrepaired cleft palate to feed effectively, unless the valve is removed. This does increase the likelihood of spills. Straw cups are also typically not recommended, unless they are pliable and allow the caregiver or infant to squeeze the bottle to push the liquids through the straw and into the mouth. Once the palate repair is performed and the cleft team has provided approval, these suction-driven cups and straws may be presented to the infant.

**Complex Craniofacial Anomalies**

For infants without syndromes or other anomalies, clefting alone usually has little effect on early feeding success when these simple feeding modifications are utilized (Miller, 2011). These infants should be able to
meet their nutrition and hydration needs without any non-oral means of feeding. If additional feeding challenges are noted or comorbidities are suspected, collaboration with specialists may be required to ensure appropriate care. There should be a low threshold for this as additional syndromes are present in 30% of infants with clefts (Mossey & Modell, 2012).

For infants with additional medical diagnoses, further feeding and swallowing assessments may be necessary if signs or oral and/or pharyngeal dysphagia exist. Clinicians who possess advanced training with complex pediatric patients should perform these bedside and instrumental evaluations. These assessments should guide the feeding recommendations and also provide a comprehensive treatment plan for the patient, which will be followed by the home therapist and caregivers.

Feeding plans are especially difficult for infants who are found to aspirate on instrumental assessments, as the use of thickened fluids in specialty feeding systems is challenging due to the one-way flow valves used in some specialized bottles (Miller & Madhoun, 2016). This often necessitates a collaborative approach with the cleft team and other professionals who treat the infant, demonstrating the need for knowledgeable and trained clinicians.

Multidisciplinary Care
It is essential that a multidisciplinary Cleft Palate/Craniofacial Team manage infants with clefts. These professionals have specialized training in the assessment and management of children with craniofacial anomalies. Standards have been developed by the American Cleft Palate-Craniofacial Association to ensure that team composition and functioning is appropriate to meet the needs of these children. Teams often consist of a plastic and reconstructive surgeon, otolaryngologist, speech-language pathologist, geneticist, dentist, orthodontist, maxillofacial prosthodontist, feeding specialist, audiologist, dietician, and nurse practitioner. These providers work together to develop appropriate treatment plans for patients from birth to adulthood.

Treating clinicians in the home and community who are working with children with cleft lip and/or palate should be in contact with the team members treating the patient. Guidelines and recommendations may differ between institutions and surgeons and are also individualized for the specific patient, making this communication key. These discussions may determine the feeding system and milk type used as well as the timeline for solid food and cup introduction.

Summary
Feeding is often one of the initial challenges families face when welcoming a baby with a cleft palate. Therefore, the clinicians treating these infants must provide support and specialized care to meet the needs of this unique population.

References


ACDF and Dysphagia: What We Know So Far

Jolene Lawton

Abstract

Objective: To determine the possible physiological changes in swallow function resulting from anterior discectomy and fusion (ACDF) surgery as determined by instrumental assessment, as well as likely prognosis for patients with the disorder, and potential treatment implications.

Method of Review: A search of Medline and Google Scholar yielded a total of seven articles that described swallowing impairment after ACDF using instrumental assessment. The seven articles received an in-depth examination, and trends were noted across studies. In addition, information regarding neural pathologies and post-operative edema from the orthopedic literature was included to help inform clinicians about the mechanisms and prognoses of impairments.

Findings: Post-surgical pharyngeal wall edema, or recurrent laryngeal nerve paralysis were the primary etiologies implicated in dysphagia. The most common swallowing impairments reported include vallecular residue with poor clearance, decreased or absent epiglottic inversion, absent or reduced pharyngeal wall movement, decreased superior hyolaryngeal excursion, and dysfunctional upper esophageal sphincter. Dysphagia resolved within two months for 71% – 100% of premorbidly normal patients. There is a lack of studies addressing behavioral treatments to improve swallow function in this population.

Conclusions: Consideration for the underlying cause of the dysphagia, prognosis for spontaneous recovery, post-operative contraindications, and evidence-based treatment techniques should be taken to determine optimal management for each individual patient.

Learning Objectives

1) Describe a common pattern of dysphagia leading to aspiration in this population.
2) Compare the hypothesized etiologies for dysphagia in patients following anterior cervical discectomy and fusion (ACDF).
3) Determine appropriate therapeutic approaches to managing a patient with severe dysphagia after ACDF.

There is currently no standard of care for assessing and treating patients suffering from dysphagia resulting from anterior cervical discectomy and fusion (ACDF) surgery. To provide optimal services for any patient with dysphagia, a thorough understanding of the underlying etiology, pathophysiology, and evidence-based research of the disorder is crucial. ACDF is a surgery that involves removing a damaged cervical disc to relieve spinal cord or nerve root pressure, typically due to a herniated disc, degenerative disc disease, bone spurs or spinal stenosis, through the front of the throat. It has been well documented that some patients experience difficulty swallowing following this procedure, but the incidence reported in the literature varies from 2.5% (Singh, Marquez-Lara, Nandyala, Patel, & Fineberg, 2013) to 71% (Rihn, Kane, Albert, Vaccaro, & Hilibrand, 2011) depending on the researcher’s methods for acquiring data. This article aims to summarize the theories about the underlying cause of dysphagia, common physiological findings based on instrumental assessments, and prognostic information to help guide clinicians in management of these patients.

What ACDF Surgery Entails

Surgery generally takes 1-3 hours and many patients are discharged home on the same day (Bohinski, 2016). The patient is placed under general anesthesia and intubated. It is the surgeon’s preference as to whether to enter through the right or left side of the neck.
Goldberg and Hilibrand (2003) describe the surgery in detail:

A 3- to 4-cm transverse incision is made in Langer’s lines beginning at the medial border of the sternocleidomastoid muscle and carried just across the midline. ... Blunt dissection is used to dissect down to the carotid sheath medial to the sternocleidomastoid muscle. Once the carotid sheath is identified, the carotid pulse is palpated and finger dissection carried down the anterior aspect of the vertebral bodies between the carotid pulse and the trachea and esophagus. ... Next, the medial attachments of both longus colli muscles are dissected free from the anterior surface of the desired vertebral segments with unipolar cautery. Hand-held or self-retaining retraction blades are inserted beneath the longus colli musculature bilaterally to facilitate the operative exposure and to avoid injury to carotid sheath structures laterally and the trachea, esophagus, and recurrent laryngeal nerve medially. No attempt is made to identify the recurrent laryngeal nerve.

The surgeon then locates and removes the damaged disc and any bone spurs impeding on the spinal nerve roots. To fill the empty space left after removal of damaged discs, a bone graft is inserted between the vertebrae. The bone graft is often reinforced with a metal plate screwed into the vertebrae to provide stability during fusion. The metal plate is visible during video fluoroscopic swallow studies. (p. 188-189)

Incidence

There are a multitude of studies using surveys to determine incidence, risk factors, and prognosis of dysphagia following ACDF. Many of these studies use unvalidated surveys to collect subjective patient reports. Bazaz and colleagues (2002) developed one such survey. The survey is a simple Likert scale that describes a patient’s dysphagia as “none,” “mild,” “moderate,” or “severe” based on a telephone interview. Patients who experienced rare episodes of dysphagia were graded as having “mild” dysphagia. Patients who reported occasional difficulty swallowing specific foods were graded as having “moderate” dysphagia. If the patient reported frequent difficulty swallowing the majority of foods, they were diagnosed with “severe” dysphagia. Bazaz and his colleagues (2002) reported incidences of dysphagia in 50.2%, 32.2%, 17.8%, and 12.5% of participants at 1, 2, 6, and 12 months, respectively. However, only one of the respondents was considered to have severe dysphagia at the 6- and 12-month marks (Bazaz, Lee, & Yoo, 2002).

A problem with using patient-reported outcomes to establish incidence of a disorder is that subjective complaints of dysphagia do not consistently correspond with instrumental findings, including potential for both false positives and false negatives (Frempong-Boadu et al., 2002; Smith-Hammond et al., 2004). An individual’s definition of “occasional” and “frequent” are subject to highly variable interpretation, as are the descriptive terms “mild” and “moderate.” However, it is important that surgeons are aware that many of their patients may report experiencing a change in their swallow function after ACDF.

More recently, Hughes et al. (2018) created and validated a survey derived from specific voice and swallowing changes reported by patients after ACDF. The resulting questionnaire asks a respondent how often they experience specific swallowing problems (e.g., “regurgitated food or pills”) that may be common in this population. The total score captures both impairments to swallowing and voice; a lower score indicates worse dysphagia and/or dysphonia. The responses may help a clinician better prepare for instrumental assessment and management options.

Ideally, this survey will be used in conjunction with instrumental assessment in future research to potentially establish correlations between underlying physiological impairments with subjective patient complaints.

To date, to this author’s knowledge, there are only seven studies that used instrumental assessment to describe physiological changes in swallow function following ACDF. Videofluoroscopy is the gold standard technique in assessing swallow function and can provide important information on physiological changes occurring after this surgical procedure.

Impact of ACDF on Swallowing Based on Instrumental Assessment

Crucial to the management of dysphagia is an understanding of the underlying physiologic...
impairments experienced by the individual. To determine the most common physiological changes that many researchers have documented after ACDF, a summary of findings based on seven studies using videofluoroscopic evaluation of the swallow was compiled. The most common swallowing impairments reported include vallecular residue with poor clearance (Frempong-Boadu et al., 2002; Leonard & Belafsky, 2011; Martin, Neary, & Diamant, 1997; Muss et al., 2017; Carucci, Turner, & Yeatman, 2015; Ryu et al., 2012), decreased or absent epiglottic inversion (Carucci et al., 2015; Leonard & Belafsky, 2011; Martin et al., 1997), absent or reduced pharyngeal wall movement (Carucci et al., 2015; Leonard & Belafsky, 2011; Martin et al., 1997), decreased superior hyolaryngeal excursion (Leonard & Belafsky, 2011; Martin et al., 1997; Muss et al., 2017), and dysfunctional upper esophageal sphincter (Carucci et al., 2015; Leonard & Belafsky, 2011; Martin et al., 1997).

Less commonly reported findings included total absence of swallow response and oral stage deficits (Martin et al., 1997). Surgical complications were also reported in some articles, including pharyngeal abscess (Carucci et al., 2015; Martin et al., 1997), collapse of the cervical fusion (Martin et al., 1997), esophageal perforation (Carucci et al., 2015), and hardware or bone graft displacement (Carucci et al., 2015), that also resulted in dysphagia.

All seven studies reported penetration and/or aspiration, and several of the authors noted a lack of cough response following some aspiration events, i.e. silent aspiration (Martin et al., 1997; Ryu et al., 2012; Smith-Hammond et al., 2004). However, limited description is provided as to when or why the aspiration occurs. Smith-Hammond and colleagues (2004) indicated that the “typical pattern of dysphagia” included aspiration occurring after the swallow from pyriform sinus residue. Martin and colleagues (1997) observed aspiration in one participant with an absent pharyngeal swallow. Other participants in the study had aspiration in conjunction with reduced hyolaryngeal elevation, absent epiglottic retroflexion, and pyriform sinus residue. An additional two participants with primarily oral phase deficits, including premature spillage of the bolus into the pharynx, also exhibited aspiration. Leonard and Belafsky (2011) only indicate that aspiration occurred with either small bolus sizes or during more challenging swallowing tasks such as straw drinking.

Several studies examined participants before and after surgery. Premorbid swallow abnormalities were found in some patients prior to surgery, which the authors suggested may be attributed to myelopathy resulting from cervical spondylosis causing spinal cord compression (Frempong-Boadu et al., 2002). Three of the patients with premorbid swallowing abnormalities in their study actually showed improvement in swallowing after ACDF.

Underlying Etiology
The seven instrumental studies indicated pharyngeal wall edema (Carucci et al., 2015; Frempong-Boadu et al., 2002; Leonard & Belafsky, 2011; Martin et al., 1997; Muss et al., 2017) or recurrent laryngeal nerve paralysis (Frempong-Boadu et al., 2002; Ryu et al., 2012) were the primary underlying impairments explaining dysphagia and dysphonia. Displacement of the pharynx or esophagus can occur from soft tissue edema or surgical hardware obstruction (Carucci et al., 2015). Edema may be caused by bleeding and intraoperative soft tissue trauma (Muss et al., 2017). This edema can obstruct epiglottic retroflexion, which results in vallecular residuals and an unprotected airway. Perhaps edema or injury to the pharyngeal muscles themselves also impedes pharyngeal movement that supports hyolaryngeal excursion.

Interestingly, Kepler and colleagues (2012) measured extent of pharyngeal soft tissue edema in patients after ACDF who complained of difficulty swallowing and found no significant difference in amount of edema when compared to patients who did not complain of difficulty swallowing. Instrumental assessments confirmed a lack of physiological swallowing impairments in some patients despite an increase in pharyngeal wall thickness (Frempong-Boadu et al., 2002; Muss et al., 2017). This indicates that edema alone may not be sufficient to cause dysphagia.

Recurrent and superior laryngeal neuropathy has been hypothesized to result from stretch injury during retraction of the larynx during the surgical procedure (Apfelbaum, Kriskovich, & Haller, 2000). Pyriform sinus residue is correlated with recurrent laryngeal nerve (RLN) damage (Ryu et al., 2012) and likely due to poor
bolus clearance through the upper esophageal sphincter (UES). The RLN branch of the vagus nerve (CN X), and its anatomic neighbor the accessory nerve (CN XI), supply the cervical esophagus. Injury to these nerves may lead to reduced movement of the posterior pharyngeal wall and reduced contraction of the pharynx necessary for bolus propulsion, as well as loss of adequate dilation and relaxation of the UES. Poor UES opening is potentially compounded by poor hyolaryngeal excursion that typically provides mechanical traction force to support its opening. RLN injury can also cause vocal fold paresis or paralysis.

Several studies reported vocal fold paresis in patients after ACDF using laryngoscopy. Martin et al. (1997) reported on four patients who exhibited changes in voice quality. Two were found to have a right-sided RLN paresis on examination. Frempong-Boadu et al. (2002) evaluated vocal fold function prior to and following surgery. They identified two participants in their study with vocal fold paresis. However, RLN paresis can also result from endotracheal tube injury (Apfelbaum, et al., 2000). The endotracheal tube can exert pressure on the nerve where it enters the larynx, especially if the cuff pressure of the tube is not monitored (Apfelbaum, et al., 2000). Adduction of the true and false vocal folds is an important component of airway protection during swallowing.

Older patients are more susceptible to dysphagia after ACDF (Smith-Hammond et al., 2004). This may be multifactorial, taking into consideration a potentially lower overall physiological reserve, sarcopenia, or an increased number of comorbidities. Dysphagia is also more likely after multi-level surgeries (Cho, Lu, & Lee, 2013; Frempong-Boadu et al., 2002). The explanation for this is uncertain, but may be attributed to longer surgical time, which could entail longer time stretching or compressing the RLN. Other possible explanations include presence of multi-level hardware impinging upon the pharyngeal or esophageal space, or a greater area of soft tissue subjected to trauma leading to increased pharyngeal wall edema. Kim and colleagues (2017) found a significant correlation between surgical procedure time and increase in post-surgical pharyngeal wall edema.

Prognosis
Within the instrumental studies, swallowing abnormalities resolved within two months for 71% (Smith-Hammond et al., 2004) – 100% (Frempong-Boadu et al., 2002) of premorbidly normal patients. Laryngeal neuropathy was associated with worse prognosis (Ryu et al., 2012). Stretching of the nerve may cause neuropraxis or axonotmesis. Neuropraxis is defined by a transient loss of neural conduction caused by a segmental demyelination. Axonotmesis indicates injury to both the axon and myelin sheath, disrupting axonal continuity. Per Martins, Bastos, Siqueira, Heise, & Teixeira (2013), prognosis for spontaneous recovery of neuropraxis is good, with nerve function recovered within days or weeks. If axonal continuity is disrupted, spontaneous recovery may take months, but is still possible. This may explain the course of gradual recovery experienced by patients who are impaired for weeks or months following surgery. Edema is also associated with temporary impairment as it tends to reduce with time. One study documented a significant decrease in post-operative pharyngeal wall edema by 6-weeks; however, measurements had still not returned to baseline values at that point (Kepler et al., 2012).

Leonard and Belafsky (2011) had similar findings such that participants who were examined more than two months after ACDF had reduced posterior pharyngeal wall thickness compared to those examined within two months of surgery. However, both groups had significantly more posterior wall thickness compared to a control group.

Kim and colleagues (2017) prospectively measured diameter of pharyngeal wall edema in 106 patients prior to and for up to a year after ACDF. They found that pharyngeal wall edema after ACDF decreased at different rates when comparing tissue thickness at cervical spine level 3 (C-3) to cervical spine level 6 (C-6). At both levels, there was a statistically significant increase one month after surgery compared to pre-surgery. They found that there was no statistically significant difference after three months at C-3 level while edema persisted at the C-6 level. However, there was also no significant difference at C-6 level compared to baseline by the six-month assessment, indicating a relative return to baseline for the patients as a group within six months.
There are several pre- and peri-operative methods proposed to reduce incidence of dysphagia, including careful selection of the plate used to stabilize the graft, and use of retropharyngeal steroids to reduce edema (Cho et al., 2013). Deflating the endotracheal cuff while the trachea is retracted during surgery may reduce RLN paresis (Apfelbaum, et al., 2000). Tracheal traction exercises were reported to reduce post-operative dysphagia in a randomized control trial (Chen et al., 2012). The exercises are hypothesized to improve the compliance of the trachea and esophagus, thereby reducing the pressure between the retractor blades and the pharyngeal/esophageal wall during surgery. However, their outcomes relied solely on administration of the Bazaz survey (described above). Further research using validated and objective assessment would yield more convincing outcomes for use of pre-operative tracheal traction exercises.

Treatment Options to Consider and Avoid

There is a lack of studies addressing behavioral treatments, such as, those recommended by speech-language pathologists to improve swallow function in this population. Consideration for the underlying cause of the dysphagia, prognosis for spontaneous recovery, surgical contraindications, and evidence-based treatment techniques should be taken to determine optimal management for each individual patient.

Smith-Hammond and colleagues (2004) documented recommending dietary modifications for the majority of their participants with dysphagia. If a patient is not ready for an oral diet, an ice chip protocol with an emphasis on oral hygiene may be considered as a relatively safe way to stimulate the swallow mechanism and maintain or build strength until the patient is ready for other foods or liquids (Pisegna & Langmore, 2018).

Smith-Hammond and colleagues (2004) also recommended several swallowing strategies, including head turn towards the surgical side and volitional throat clear. Frempong-Boadu and colleagues (2002) implied that many of their participants were prescribed a chin tuck or supraglottic swallow for milder cases of dysphagia. However, clinicians need to be aware that the surgeons who carry out these procedures may advise their patients against these specific movements (head turn, neck flexion) for up to six weeks after surgery during the healing process (Bohinski, 2016; Dewitt, 2015; Houle, Papavasiliou, Murray, & Nakata, 2018). Supraglottic swallow and effortful swallow strategies could be beneficial for airway protection and bolus propulsion, respectively. Ideally, these strategies are tested under fluoroscopy to determine their effectiveness for each individual patient.

The Mendelsohn maneuver is one exercise that may improve hyolaryngeal excursion (Inamoto et al., 2017; McCullough & Kim 2013). Chin tuck against resistance is another exercise reported to improve hyolaryngeal excursion (Park, An, Oh, & Chang, 2018; Yoon, Khoo, & Rickard Liow, 2014), but would have to be cleared by the physician prior to its use due to the aforementioned contraindications. Neither of these exercises have been studied in patients with dysphagia after ACDF, to this author’s knowledge.

Discussion

Ideally, patients considering ACDF surgery, in conjunction with the medical team, will be well aware of the various factors that may increase risk for negative outcomes on post-surgical swallowing function. Speech-language pathologists should build relationships and share evidence-based information with surgeons in their communities. Education to the medical team must include an emphasis on the importance of referring patients for instrumental assessment should they report or show any symptoms of dysphagia, including pulmonary complications, after surgery. Perhaps speech-language pathologists can also be available to answer patients’ swallowing-related questions prior to surgery.

Clinicians have a duty to understand the underlying physiological changes to the swallow mechanism that occur in each patient to determine the optimal course of treatment. While there do seem to be trends toward a pattern of swallowing impairment in this population, variability in the characteristics of dysphagia are evident. Videofluoroscopic findings in conjunction with clinical observations (i.e., new onset dysphonia) can provide clues as to cause of the dysphagia. Fortunately, in both cases of pharyngeal wall edema and laryngeal neuropathy, spontaneous recovery is possible for the majority of patients within two to three months’ time.
Special care should be taken to avoid postural changes (e.g., head turn, chin tuck) during the critical postoperative healing period, which may last up to six weeks. Again, strong communication with the patient’s surgeon is imperative to avoid potentially harming your patient. Finally, speech-language pathologists who work with this population routinely may consider presenting on or publishing experiences they have in managing their patients with chronic dysphagia following ACDF to further the knowledge base for speech-language pathologists everywhere.

References:


What does Diabetes have to do with Cognition and Swallowing?

Marnie Kershner and Paula Leslie

Abstract
Speech-language pathologists working with adults in medical settings are likely to encounter patients with a diagnosis of diabetes mellitus on a regular basis (NCD Risk Factor Collaboration, 2016). The current literature supports an association between diabetes and cognitive impairment (Moreira, Soldera, Cury, Meireles, & Kupfer, 2015; Vincent & Hall, 2015). Mild impairments in executive functioning are of particular relevance in this population. Even within the range of normal cognitive abilities, reduced executive functioning can negatively impact patients’ self-management of their diabetes (and potentially adherence to therapy programs and strategies) and therefore their overall health. Mild cognitive deficits in this population are therefore clinically relevant and may warrant intervention (Vincent & Hall, 2015). Diabetic complications may also impact digestion, indirectly impacting patients’ intake and tolerance of food and drink (Borgnakke, Anderson, Shannon, & Jivanescu, 2015; Gatopoulou, Papanas, & Maltezos, 2012; Hüppe et al., 1992; Sandberg, Sundberg, Fjellstrom, & Wikblad, 2000).

Learning Objectives
1) Describe common complications of diabetes.
2) Describe cognitive impairments associated with diabetes.
3) State the potential impact of diabetes on swallowing.

Diabetes is a chronic, progressive disease with the potential to lead to significant disability. Diabetes impacts endocrine and vascular function. Type I diabetes is typically diagnosed in childhood or early adulthood where the body does not make its own insulin and people need to take insulin daily. Type II is typically diagnosed in adulthood (Unger, 2013). Type II is more common than type I accounting for 90-95% of all diabetes cases in the US (Ghosh & Collier, 2012; National Institute of Diabetes and Digestive and Kidney Diseases [NIDDK], 2016). According to a 2017 report from the Centers for Disease Control and Prevention, approximately 30.3 million people in the US had diabetes equivalent to the populations of New York and Michigan states combined (CDC, 2017).

In type II diabetes the body destroys insulin-producing beta cells of the pancreas (necessary for blood sugar regulation) and develops insulin resistance.

Macrovasculature (large blood vessels) and microvasculature (small blood vessels) can be damaged in diabetes. Common microvascular complications include retinopathy, nephropathy and neuropathy. These are vascular-based disorders of the eyes, kidneys and nerves respectively (Ghosh & Collier, 2012). Distal structures such as the hands and feet are typically affected first because they are especially rich in microvasculature. The microvasculature of the digestive tract and brain are also susceptible. The blood supply to nerves may be progressively destroyed (i.e., neuropathy) in diabetes resulting in the progressive reduction of viable nerves (Moreira, Soldera, Cury, Meireles & Kupfer, 2015) as nerves require adequate blood supply to function and survive. Risk factors for diabetic neuropathy include obesity, hypertension, tobacco use, a family history of diabetic neuropathy and advancing age (Unger, 2013).

So how do patients with diabetes fit into the speech-language pathology scope of practice? The American Speech-Language Hearing Association (ASHA) supports...
Approximately 60% of older adults with diabetes have isolation, particularly for older adults (≥65 years). It is important to note that medical diagnoses rarely present in isolation, particularly for older adults (≥65 years). Approximately 60% of older adults with diabetes have at least one additional chronic medical condition; up to 40% have ≥4 chronic medical conditions (Huang, 2016). Older adults may have multiple chronic medical conditions that carry risk for cognitive impairment. As an example: older hospitalized adults with heart failure scored poorer on the Mini Mental State Exam when compared to healthy controls and those who also had diabetes scored even lower (Basile et al., 2013).

**Diabetic Complications: Cognition**

Type II diabetes has been found to be associated with reduced performance on executive functioning tasks in adults. In a 2015 meta-analysis, adults with type II diabetes showed reduced performance across executive functioning tasks when compared to healthy controls (verbal fluency, mental flexibility, inhibition and attention) (Vincent & Hall, 2015). The effect sizes across executive function domains were small, but consistent and these findings are clinically relevant. Impaired executive functioning, even within the normal range “...has been linked to worse adherence to medical treatment, physical activity non-adherence, and worse dietary control, all of which are important to adequate [type II diabetes] management” (Vincent & Hall, 2015, p.639).

Studies of animal models with microvascular disease due to diabetes have found functional and structural changes in the brains of these animals. These changes caused impaired cerebral perfusion (blood flow) and impaired neural recovery after insult (e.g., following a cerebrovascular accident or traumatic brain injury) (De Silva & Faraci, 2016). These findings help us hypothesize what the underlying mechanisms of cognitive-communication impairment may be in humans with diseases impacting the microvasculature. At present, the clinical literature on this topic in human subjects is limited and inconclusive (Moreira et al., 2015).

SLPs working with adults in healthcare settings are aware that medical diagnoses rarely present in isolation, particularly for older adults (≥65 years). Approximately 60% of older adults with diabetes have autonomic neuropathy (primarily affecting nerves that regulate internal organs) related to diabetes can result in additional dysfunction further down the digestive tract (Gatopoulou, Pappas & Maltezos, 2012; Hüppe et al., 1992). These impairments include esophageal dysmotility, gastroesophageal reflux disease (GERD), gastroparesis (impaired emptying of the stomach), constipation, diarrhea and fecal incontinence. These impairments in digestion are essential for the SLP to be aware of because they impact patients’ tolerance of oral diets, and may increase risk for aspiration of gastric contents (as may be the case for a patient with esophageal dysmotility, GERD, gastroparesis or constipation).

**Diabetic Complications: The Digestive Tract**

Safe and comfortable tolerance of an oral diet requires more than the safe passage of food and drink through the upper esophageal sphincter. The entire digestive tract plays a role. Diabetes can have harmful effects throughout the digestive tract. Starting in the mouth, diabetes is associated with a higher risk for poor oral health – and consequently – poor oral hygiene (Borgnakke, Anderson, Shannon, & Jivanescu, 2015; Sandberg, Sundberg, Fjellstron & Wikblad, 2000). Poor oral hygiene, in the setting of aspiration or oral secretions, is an established risk factor for developing pneumonia (Yoneyama et al., 2002). In an exploratory case-control study the prevalence of xerostomia (i.e., dry mouth), advanced periodontitis, oral mucosa abnormalities, plaque and bleeding gums were significantly greater in adults with type II diabetes when compared to healthy controls (Sandberg et al., 2000).

Autonomic neuropathy (primarily affecting nerves that regulate internal organs) related to diabetes can result in additional dysfunction further down the digestive tract (Gatopoulou, Pappas & Maltezos, 2012; Hüppe et al., 1992). These impairments include esophageal dysmotility, gastroesophageal reflux disease (GERD), gastroparesis (impaired emptying of the stomach), constipation, diarrhea and fecal incontinence. These impairments in digestion are essential for the SLP to be aware of because they impact patients’ tolerance of oral diets, and may increase risk for aspiration of gastric contents (as may be the case for a patient with esophageal dysmotility, GERD, gastroparesis or constipation).
polypharmacy as the use of multiple medications at one time, with various cut-offs for the number of medications. Medication side effects can trigger a prescription cascade; drugs can start to be added to a patient’s list to manage symptoms that are actually side effects of other medications (Wise, 2013). Adverse medication interactions and medication side effects can cause or contribute to deficits in cognition and swallow function (Gallagher & Naidoo, 2009; Maher et al., 2014). Dysphagia may be induced by medications, or indirectly impacted by medications (e.g., reduced nutritional status, dehydration, dry mouth, impaired taste, reduced oral hygiene/health) (Gallagher & Naidoo, 2009). When in doubt, it is appropriate for the SLP to suggest that the medical team consider a medication review with the aim to reduce the overall burden on the patient.

**Recommendations for Management - SLP Role**

Diabetes is associated with mild cognitive impairments (Moreira et al., 2015; Vincent & Hall, 2015). Mild impairments in executive functioning, even within the range of normal, are clinically relevant and may warrant intervention (Vincent & Hall, 2015). Careful screening and higher-level assessment should be considered to identify subtle impairments in patients with diabetes. Cognitive treatment should focus on functional compensatory strategies, taught in the context of daily tasks relevant to patients’ specific needs (Moro et al., 2015). For patients with diabetes, tasks may relate to increasing independence in disease management (e.g., monitoring blood sugar, managing medications). Significant others and/or caregivers should be included in treatment when possible to support generalization (Moro et al., 2015). Referrals to dentistry and gastroenterology are encouraged given the established associations between diabetes (± diabetic neuropathy) and poor oral health (Borgnakke et al., 2015; Sandberg et al., 2000), and between diabetic neuropathy and a variety of gastrointestinal (GI) complications (Gatopoulou et al., 2012; Hüppe et al., 1992).

**Practicalities of Management.** The SLPs role in addressing cognition in patients with diabetes may include advocacy, screening, assessment, treatment, counseling, education and/or onward referrals.

- Executive功能 impairments are of particular concern in this population, and especially for individuals who do not have daily assistance with diabetes management. When in doubt, screen.
- Treatment should be functional and related to the patient’s specific day-to-day needs.
- Significant others and/or caregivers should be involved when possible to support carryover.
- The *Mild Cognitive Impairment Questionnaire* (Dean, Jenkinson, Wilcock, & Walker, 2014) evaluates emotional and practical quality of life concerns in adults with mild cognitive impairment and may be a helpful tool to consider for patients in this population.

**Interdisciplinary Considerations.** When responding to swallow consults for patients with diabetes (especially for consults related to “poor PO intake”) the SLP should remember that the oropharynx does not exist in isolation. While periodontitis and gastroparesis are outside of the SLP scope – making appropriate referrals is within the SLP scope.

- Such referrals may be made to:
  - Dentistry
  - Gastroenterology
  - Pharmacy

**References**


Multisystemic Impact of Frailty and Sarcopenia on Swallow Function and Dysphagia

Donna Edwards

Abstract
The interaction of sarcopenia and frailty have a multisystemic impact that may be associated with swallow function and dysphagia. Though this relationship is not fully understood, the cyclical impact of the biological and physiological substrates inherent in sarcopenia and frailty on swallow function is significant. Inherent within the life cycle is the drive to obtain sufficient nutrition and hydration efficiently to support life. As the cycle of reduced physiological function presents with neurogenic and neurodegenerative processes, muscular weakness and sarcopenia may occur in tandem with apparent exhaustion, reduced drive and at times undernourishment. For best clinical outcomes and evidenced based practices, one must acknowledge and synthesize concomitant risk factors influencing the daily function of individual clients and families.

Learning Objectives
1) Define sarcopenia and frailty.
2) State three attributes related to swallow function in elders having sarcopenia and frailty.
3) State three future considerations to optimize care for elders having sarcopenia and frailty.

Historical Definition of Sarcopenia
Collaborative efforts through the European Working Group on Sarcopenia in Older People (EWGSOP) posed the definition of sarcopenia as a multi-system syndrome related to frailty and characterized by chronic, progressive decline in skeletal muscle mass and function leading to decreased strength and functional performance (Cruz-Jentoft, et al, 2010). The shared model elaborated upon primary and secondary categories of sarcopenia associated with causal agents. The primary category was associated exclusively with the process of aging. The secondary category was associated with levels of inactivity and disease processes. For example, deconditioning was attributed to a sedentary lifestyle, lengthy periods of bedrest, and advanced disease processes that commonly affect multiple physiological subsystems. The secondary category also incorporated the impact of nutritional deficits such as reduced protein intake, gastrointestinal disorders and certain medication side effects. (Cruz-Jentoft, et al, 2010). We should consider, if sarcopenia is a component of frailty, what then is the definition of frailty?

Historical Definition of Frailty
Fried and colleagues (2001) published works exploring evidence of a phenotype related to frailty in older adults supporting an intermediate stage identifying those at high risk for frailty and posing that disability is an outcome of frailty. By 2009, Fried and colleagues constructed a cycle of ‘energy dysregulation’ that identified components of weight loss, exhaustion, weakness, reduced walking speed and levels of reduced activity as common critical factors found in this at-risk population. It was determined that having 3 of these 5 factors at abnormal levels was determined to be frail status. Using a common standard optimizes factors at abnormal levels was determined to be frail status. Using a common standard optimizes level of care and opportunities for education. However, thoughtful reflection in determination of patient status must also include understanding that additional physiological manifestations may be present.

Considerations in Clinical Care
It is evident that a myriad of factors need considered as one critically analyzes the full dynamic involved in patient presentation. In a study by Fried (n.d.) comorbid diagnoses, such as insulin resistance, lent themselves to additional complications of obesity, chronic

Donna Edwards M.A., CCC-SLP, BCS-S, ASHA-F is employed by Baldwin-Wallace University.
Financial – Is an associate professor in the communication disorders program at Baldwin-Wallace University. Has a patent pending for a jaw function measurement apparatus. Is an author of two free educational coloring books to reduce choking risk in the pediatric population.
Nonfinancial – Is a national and international speaker and a board-certified specialist in swallowing and swallowing disorders.
inflammation and cardiac disease processes. These changes in physiological function were found to result in an increased fall risk, minimized health reserves prior to an event or disease process, disability, reduced outcome measures for hospitalization or surgical interventions, delayed or incomplete recovery, and mortality (Fried, n.d.).

A deliberate clinical view to optimize care must also consider possible socioeconomic or psychosocial stressors that may negatively influence best outcomes and functional application as we strive to optimize swallow function across settings. Such stressors might include poverty, disability restrictions, limited access to foods, polypharmacy interactions, and an increased vulnerability for social isolation or depression (Fried n.d.). As clinicians and researchers, we strive to integrate critical analysis of multifactorial facets that surround patient care and outcomes.

Pathophysiological Impact
Morley and colleagues (2013) determined that inadequate nutritional support and declining micronutrients in the elder population may result in breaking down of adipose tissue and muscle stores of protein and carbohydrates that are necessary for cell energy and metabolism maintenance. The loss of energy reserves promotes physical decline and an increased risk to the patient. Potential preventative measures offered included nutritional therapy, such as calorically dense foods high in protein, and resistance training to offset decline in status. Additional support of Vitamin D and reduction of polypharmacy were proposed to offset physiological decline.

Milte and Crotty (2014) enriched our understanding and application of frailty related to musculoskeletal and non-musculoskeletal functions. Common musculoskeletal issues related to aging include osteoarthritis, osteoporosis, and presence of fragility fractures. Furthermore, they found that the presence of chronic low-level inflammation appeared associated with age-related decline and high risk of sarcopenia and frailty. Presentation of such musculoskeletal concerns may negatively impact client range of motion and endurance for positioning or swallow techniques.

Association with Swallow Function
The presence of oropharyngeal dysphagia has an association with morbidity, mortality and hospital readmission for the elder client with community-acquired pneumonia (Ortega et. al. 2015). A thorough oromotor examination of structures and functions is necessary. Clinically we are able to ascertain that several features may affect the client’s oral phase of the swallow. Attention to presence/absence of dentition and fit of dentures may influence the ability to masticate the bolus fully. The level of hydration, xerostomia and presentation of mucosa may indicate sufficient or insufficient moisture for bolus cohesion and manipulation (Murakami et al., 2015). Poor oral health and hygiene may result in colonization of bacteria resulting in higher risk of infection to the lower respiratory tract. Reduced saliva management may be indicative of oromotor dysfunction (Ortega, Martin & Clave, 2017). Lingual function to shape, manage and transfer a bolus, labial seal and buccal strength to establish and sustain intraoral pressure may affect efficiency of the client’s oral phase of swallow function.

The relationship between oral function and community-dwelling elders was explored by Watanabe and colleagues (2016) to enrich our understanding. Their work compared oral function in relation to 4,720 healthy elders, of which 535 were determined to be frail. Care was taken to evaluate dentition, occlusal force, masseter thickness, diadochokinesis, blood chemistry, comorbidities and sociodemographic factors. Findings supported presence of age-related differences of reduced occlusal force, masseter muscle thickness and diadochokinetic rate when compared to robust elder participants. Lower albumin and triglyceride levels were associated with frailty and the concern for undernutrition. Loss of dentition was associated with decreased appetite and lower levels of energy. Reduced occlusal force and mastication were associated with lower protein intake, lower body weight and further risk of undernutrition.

Clinical comments of noting client fatigue at mealtimes as well as client anecdotal reports of needing to take longer at meals led to a work by Kays and colleagues (2010). The participants were studied to determine if changes occurred in tongue strength or endurance over the course of a meal. Results indicated that all subjects demonstrated reduced lingual strength and fatigue following the meal. Physiological age-related changes in muscle mass and elasticity of connective tissue may negatively affect range of motion and endurance over time. Oral preparation of the bolus may be more
effortful and less efficient. Slow, fatigable muscle fibers in the posterior tongue move the bolus from the oral cavity to the pharynx repeatedly over a mealtime and may prove challenging to our clients. Retraction of the posterior tongue to contact the posterior pharyngeal wall initiates the ongoing swallow sequence and facilitates ascension of the hyoid (Dodds 1989) while the anterior tongue placement against the alveolar ridge assists with necessary pressure to initiate and control the bolus during transfer. Additional considerations for this population include sensorimotor and subtle changes in taste receptors, oral moisture and olfactory receptors influencing efficiency of swallow function. How then does this apply to the frail elder?

As we continue to consider a few specific muscle functions related to swallowing, let us first consider baseline data. In 2013, Vanderwegen and colleagues examined anterior and posterior lingual strength and endurance across the lifespan in 420 healthy Belgian adults. Their findings revealed that the anterior portion of the tongue has both longer endurance and higher strength when compared to the posterior tongue. In addition, it was found that participants over 70 years of age demonstrated significantly lower lingual strength at both the anterior and posterior tongue.

Understanding that lingual pressure has a primary function in transport of the bolus, research was also undertaken by Peladeau-Pigeon and Steele (2017) to further examine the implications of changes in the relationship between lingual strength and bolus propulsion during swallow function. This study evaluated generation of anterior to posterior isometric lingual pressures and typical swallows of saliva in healthy participants. The age range was 12-79 years with a mean age of 44 years. Participants were allowed visual biofeedback. Results revealed greater pressure variability associated with lingual weakness in the posterior isometric tongue pressure tasks, while saliva swallow pressures were lower than in the isometric tasks. Certainly, additional research is warranted to further determine any relationship between lingual weakness and generation of lingual pressure patterning during functional swallow tasks (Peladeau-Pigeon & Steele, 2017).

Butler and colleagues (2011) concluded that isometric measures of lingual strength as well as anterior and posterior lingual function decreased significantly in patients positive for presence of aspiration versus those patients without noted aspiration via flexible endoscopic evaluation of swallowing. Association was made between aspiration status in a cohort of 78 community dwelling ambulatory elder adults with reduced lingual strength and pharyngeal pressure. Anterior lingual strength measured greater pressures than posterior lingual strength. Researchers posed the findings were due to age-related atrophy of orofaryngeal muscles of swallowing.

Ogawa and colleagues (2018) compared the difference in swallowing muscle mass in those with sarcopenic and nonsarcopenic dysphagia via ultrasound. They considered the concept that thickening of lingual muscles and geniohyoid and pharyngeal muscles thickness decreases with an increase in age. This research findings found that lingual muscle mass in patients with sarcopenic dysphagia was indeed smaller than those with nonsarcopenic dysphagia. Interestingly, the findings also determined that those with sarcopenic dysphagia presented with an increased intensity of lingual muscle pressure.

The geniohyoid muscle functions to elevate and stabilize the hyoid bone while assisting in airway protection. Contraction elevates the hyoid bone and drives it anteriorly together with the stylohyoid, mylohyoid and anterior belly of the digastric muscles. Feng et al. (2013) found that muscle atrophy of the geniohyoid muscle had a positive association with aging progression and potential for aspiration in older adults. They posited that sarcopenia of these muscles may play an important role in reducing hyoid bone movement during aging and the resultant increased risk of aspiration in older persons. It is crucial to understand that swallow function is a biomechanical process relying on various skeletal muscles comprising the oral, pharyngeal and esophageal complexes. Disruption in the efficiency of the balanced function may result in inefficient function or swallowing disorder.

A deeper consideration of protective physiological responses is warranted. The voluntary upregulation of the cough reflex is a protective function of the airway to sense and clear aspirate material or detect irritants. Presbyphagia, or swallowing impairment related to aging, has been researched relative to both the motor and somatosensory neural pathways. This work has expanded upon the known age-related muscular
changes in the aerodigestive tract of the elder population.

If an imaging study is warranted, whether endoscopic or fluoroscopic, a wide variety of interventions may be recommended. Typical recommendations may include compensatory strategies and client/caregiver education. Compensatory strategies, or techniques for client swallow function, are intended to optimize the safest level of oral intake of food/liquids to best meet nutrition/hydration needs, minimize aspiration risk and yet be acceptable to the client. Techniques may be assessed during instrumental assessments as well as clinical assessments. Common compensatory strategies may include postural adjustments, swallowing techniques and diet modification that incorporate rich nutrients. Though use of these techniques are common, literature support for these techniques vary (Sura, Madhavan, Carnaby & Crary, 2012).

Postural adjustments are intended to modify bolus flow and speed of bolus transfer with the purpose of increasing airway protection to optimize swallow function. Realistically, we must consider that certain adjustments may be contraindicated if the client has reduced mobility or movement patterns. For example, restricted range of head and neck motion may prohibit range of motion for such movements as head turn or chin tuck.

During imaging studies we are afforded the opportunity to objectively assess swallow function, integrate compensatory strategies if appropriate and to expand our comprehension of neurological relationships. Review of the research literature provides us with common reference points as we continue to pursue our understanding of swallow function related to dysphagia in the frail elder. Delay in the onset of the pharyngeal swallow and increased aspiration risk in the elder population has been well supported in the literature. (Robbins, Hamilton, Lof & Kempster, 2005; Rosenbek, Roecker, Wood & Robbins, 1996). Imaging studies have also given us the knowledge that pharyngeal peak pressures during swallow may be correlated with physical deterioration related to the aging process (Cock & Omari, 2018). Ebihara and colleagues (2016) noted that chronic micro-aspirations, versus an acute event, induced inflammation within the lung, which may, in turn, result in sarcopenia or reduced muscle mass and strength. Conclusions were made that sarcopenia of swallowing muscles has a direct correlation with oral frailty and dysphagia. Presence of a protective cough response was thought to reduce incidence of aspiration effects, but those patients with dystussia, or impaired protective cough response and dysphagia may have an increased risk of aspiration pneumonia. Suspicions were shared with the possible association of neurological disruption of the medullary reflex pathway as well as the cortical pathway for cough function. It was felt that an aspiration related treatment paradigm shift should occur from focus on a pathogenic treatment, involving response to the aspiration event such as use of medications, to a functional treatment having a primary focus on impeding or reversing age related decline (Ebihara et al., 2016).

Reduced somatosensory activation was further associated with aging by Malandraki and colleagues (2011). Neurophysiological activation, during the act of swallowing as seen with fMRI, included portions of the primary motor cortex, somatosensory cortex, the premotor area, the superior temporal gyrus, the lentiform nuclei, the thalamus, the insula and the bilateral parietal lobes. The cortical motor control of swallowing appeared preserved thus supporting the implication of loss of age-related function may be decline in strength or muscle mass for specific structures such as the tongue. However, significance was attributed to reduced neural activation in the primary somatosensory cortex, the sensory association and sensorimotor integration areas for the elder population, negatively influencing coordination of the swallow response.

Ebihara, Ebihara and Kohzukil (2012) depicted further understanding of neurological cortical and subcortical structures role in control of the cough reflex and swallow. Considering the cortical motoric and sensory pathways, this work supported that the aging process appeared to have more impact on the sensory receptors in reflexive circuits rather than the motor pathways.

Miles and colleagues (2013) supported cough reflex association with aspiration response during instrumental assessments and increased risk of pneumonia. Due recognition was given to the various factors that could be related to development of pneumonia. It was found that assessment of cough reflex may be appropriate for a screening measure of potential silent aspiration events.
**Future Considerations**

Cesari, Nobili and Vitale (2016) suggested future adaptations in current clinical and research practices to enhance an individualized need via integrated care for management within a holistic framework rather than based on age parameters. They suggested consideration of measuring biological homeostasis and functional status in order to achieve a more effective levels of comprehensive care. The most effective intervention found to minimize decline in skeletal musculature appears to be an intentional combination of physical exercise paired with sufficient nutritional intake, especially protein rich foods. Ebihara and colleagues (2012) proposed clinical consideration of techniques to optimize sensory neural pathways and responding cortical areas in an effort to offset aspiration pneumonia in the elder population with dysphagia. Their technique utilized olfactory stimulation with graded presentation of food challenges, from pureed to regular meals, depending upon client swallow function.

In their earlier work, Ebihara and Ebihara (2011) discussed several strategies to enhance protective cough and swallow reflexive responses included exploration of thermoreceptors, daily oral care, and olfactory stimulation. Research data supported daily oral care may improve the swallow reflex as the oral stimulation releases neuropeptides via the ‘afferent and efferent pathways of the swallow reflex’. Acknowledgement of food modification was noted, but more interestingly, incorporation of offering a variety of food temperatures during the meal seemingly had a positive result. They posed that temperatures closest to body temperature (30-40°Celsius) were less stimulating resulting in longer swallow delay and those temperatures that varied, cooler and warmer, resulted in more efficient timing of the swallow response. They suggest that foods be heated just prior to serving which also allows for appetite stimulation and improved nutrition (Ebihara & Ebihara 2011). We must acknowledge that stimulation to improve cough reflexes and swallowing is speculative, but it is of interest. Food presentation considerations included texture, temperature, overall appearance and sound. Other elements of the dynamic mealtime experience explored the components of taste. Namely, sweet, sour, salty, umami, astringency, salty and bitter for contrast. Additional enhancement was offered through olfactory stimulation. The overall meal environment was enriched when considerations included condition of the mind and body and opportunities for conversation.

**Conclusion**

Balancing swallow function, nutritional status, medical status, polypharmacy, client perspective and the client’s support system while determining the level of care is critical in hopes of offsetting the disabling cascade of symptoms associated with sarcopenia and frailty. The benefit of working with an inter disciplinary team to explore client supports and daily functional status can be integral in contributing to management of patient care. Purposeful grading of skilled care to triage and determine those most appropriate for an intensive multidisciplinary intervention, an abbreviated course of care or a self-management program is important to individualize patient need and best clinical practices (Milte & Crotty, 2014). Inherent in the level of care is recognition of any necessary clinical assessments, interventions or adaptations to facilitate client success.

Implementation of interventions to offset functional decline by slowing progression of systemic stressors that occur in tandem with frailty and sarcopenia in the elder population is posed in the literature. Promotion of nutrient rich mealtime opportunities and nutritional strategies of protein supplementation paired with physical strengthening activity, such as progressive resistance training, may reduce decline in muscle mass while enhancing strength and balance to positively influence overall quality of life. Engagement of the frail elder and family caregivers in the decision-making process and discussion of the plan of care enriches the dynamic support system to optimize resources available to each client and reflects evidenced based practice. As the professions address the global health concern of the multisystemic impact of sarcopenia and frailty on swallowing function and dysphagia, attention to concomitant risk factors and strategies for early prevention may be effective to promote quality of life for those we serve.

**References**


Continuing Education Questions

**Directions:** Choose the best answer for each question as you read each article. Then return to the [Member Continuing Education Page](#) for a link to answer the online assessment questions. A certificate of completion or ASHA continuing education units (CEUs) are available for a limited time.

**Oropharyngeal Strengthening for Swallowing Rehabilitation**

12. What provides the primary propulsive pump in swallowing?
   - a. Uvula.
   - b. Lingual Muscles.
   - c. Hyoid.
   - d. Larynx.

13. Which of the following changes with healthy aging?
   - a. Valuable size.
   - b. Tongue protrusion distance.
   - c. Tongue pressures generated during swallowing.
   - d. Isometric tongue pressure generation.

14. Which answer is NOT a key parameter in oropharyngeal strengthening?
   - a. Intensity.
   - b. Temperature.
   - c. Repetition.
   - d. Frequency.

15. Long-term follow-up of patients who completed device-facilitated oropharyngeal strengthening showed:
   - a. greater longevity.
   - b. increased alcohol consumption.
   - c. fewer hospital admissions.
   - d. greater technical aptitude.

**Through Thick and Thin: Clinical Perspectives on Consistency Modification**

16. According to the National Dysphagia Diet Task Force, foods provided to people place on a level 1 diet should:
   - a. Require some chewing.
   - b. Be reduced to a cohesive, homogenous mass.
   - c. Be low in sodium.
   - d. Have access to the same consistencies of food as people without dysphagia.

17. Consuming honey thickened liquids is associated with an elevated risk for developing which of these medical conditions?
   - a. Urinary tract infections.
   - b. Diabetes.
   - c. Pneumonia.
   - d. Depression.

18. Which of the following strategies is NOT associated with attempts to offer clients “cuisine puree”?
   - a. Using molds to help form purees into shapes that resemble non-pureed foods.
   - b. Eating in a restaurant like atmosphere.
   - c. Ensuring clients have access to foods that match their dietary preferences.
   - d. Presenting foods in an appetizing way.
19. Which of the following elements needs to be in place before a client can be enrolled in a free water program?
   a. Client should be helped to achieve and maintain very high standards of oral health.
   b. Client should be free of urinary tract infections for 6 months before the start of the program.
   c. Client should be diagnosed with dehydration.
   d. Client should have no significant history of pneumonia.

A Case of Lance-Adams Syndrome

20. Lance-Adams Syndrome typically is a result of:
   a. Laceration.
   b. Cerebrovascular Accident.
   c. Hypoxic Brain Injury.
   d. Congenital birth defect.

21. The most distinctive movement impairment is:
   a. Action Myoclonus.
   b. Tremor.
   c. Bradykinesia.
   d. Tardive dyskinesia.

22. Swallowing difficulties will most likely manifest as:
   a. Weakness.
   b. Reduced range of motion.
   c. Dry mouth.
   d. Dyscoordination.

23. Which of the following reflects the motor speech errors that would be observed?
   a. Errors would be highly regular.
   b. Errors would be highly variable.
   c. The speech subsystem of resonance would be the most salient feature.
   d. Rate of speech would remain normal.

Feeding the Infant with Cleft Lip &/or Palate

24. To decrease nasal regurgitation during bottle-feeding, infants should be placed in:
   a. A reclined position.
   b. A sidelying position.
   c. An upright position.
   d. A cross cradle position.

25. Generally, infants with clefts should begin solid foods ____________ infants without clefts.
   a. Earlier than.
   b. Later than.
   c. At the same time as.
   d. Two months after.

26. A 10 month-old infant with an unrepaired cleft palate is only allowed to eat the following solid foods.
   a. Pureed solids.
   b. Hard, crunchy solids.
   c. No solid foods.
   d. Developmentally appropriate solid foods.
27. Multidisciplinary Cleft Palate/Craniofacial Teams often includes  
   a. A speech-language pathologist.  
   b. A physical therapist.  
   c. A special educator.  
   d. A recreational therapist.  

Anterior cervical disc fusion (ACDF) and Dysphagia: What We Know So Far  
28. Which is not a recommended treatment option for a patient with dysphagia 1-month post-ACDF?  
   a. Diet modifications.  
   b. Supraglottic swallow.  
   c. Chin tuck.  
   d. Effortful swallow.  

29. Pyriform sinus residue may be due to which of the following?  
   a. Excessive upper esophageal sphincter (UES) opening.  
   b. Poor epiglottic retroflexion.  
   c. Poor oral containment.  
   d. Inadequate hyolaryngeal excursion.  

30. Which is a true statement about the prognosis of recovery from dysphagia following ACDF surgery?  
   a. Patients with recurrent laryngeal nerve axonotmesis are likely to recover spontaneously within 6 weeks.  
   b. Patients with recurrent laryngeal nerve neuropaxis are likely to recover spontaneously within 6 weeks.  
   c. Patients with multi-level surgery have a better prognosis than those with single level surgery.  
   d. Posterior pharyngeal wall swelling always resolves within one month of surgery.  

31. Which of the following is not suggested as an underlying etiology of dysphagia in this population?  
   b. Intubation injury to the recurrent laryngeal nerve.  
   c. Bone graft displacement.  
   d. Immobility of the cervical spine.  

What does diabetes have to do with cognition and swallowing?  
32. Microvascular complications of diabetes most commonly impact:  
   a. The lungs and diaphragm.  
   b. The eyes, kidneys and nerves.  
   c. The phrenic nerve.  
   d. Myocardium and tricuspid valve.  

33. Cognitive impairment associated with diabetes is typically:  
   a. Mild affecting mainly executive functions.  
   b. Waxes and wanes and results in “sundowning”.  
   c. Severe across all domains.  
   d. Cognitive impairment is not associated with diabetes.  

34. Unaddressed mild impairments in executive function in adults with diabetes:  
   a. Will improve overtime without intervention.  
   b. May negatively impact health outcomes.  
   c. Are the domain of the cognitive neuropsychologist.  
   d. Only need addressing if the patient is hoping to return to work.
35. Diabetes is associated with impairments throughout the digestive tract including:
   a. Diverticulosis.
   b. Gastrointestinal bleeding.
   c. Poor oral health and esophageal dysmotility.
   d. Severe oropharyngeal dysphagia.

**Multisystemic Impact of Frailty and Sarcopenia**

36. The components of energy dysregulation include:
   a. Kyphosis, anemia, paraparesis, reduced walking speed, and weight gain.
   b. Dyskinesia, immobility, dysarthria, paraplegia, weight loss and reduced walking speed.
   c. Weight loss, weakness, exhaustion, and reduced walking speed.
   d. Weight loss, reduced walking speed, paraplegia and kyphosis.

37. Inadequate nutrition and declining micronutrients in the elder population results in:
   a. Breaking down of adipose tissue and muscle stores of protein and carbohydrates.
   b. Diabetes, weight gain and inactivity.
   c. Breaking down of red blood cells, anemia and sleeplessness.
   d. Anemia, constipation, loss of balance, and reduced protein reserves.

38. Factors that may affect oral phase efficiency and function include:
   a. Nasopharyngeal sufficiency, lingual function and labial seal.
   b. Lingual function, labial seal, and buccal strength.
   c. Labial seal, lingual function and timing of swallow initiation.
   d. Labial seal, nasopharyngeal sufficiency, diet level and buccal strength.

39. Fibers in the posterior tongue that transfer the bolus from the oral cavity to the pharynx are:
   a. Slow, fatigable muscle fibers.
   b. Fast, fatigable muscle fibers.
   c. Type A muscle fibers.
   d. Type B muscle fibers.
Guidelines for Submission to eHearsay

eHearsay, the electronic journal of the Ohio Speech-Language Hearing Association, is designed to address the professional development needs of the members of the state association.

OSLHA publishes manuscripts relevant to the fields of speech-language pathology and audiology and adheres to American Speech-Language-Hearing Association (ASHA) Guidelines for the Responsible Conduct of Research: Ethics and the Publication Process [1].

Types of Manuscripts
Contributed manuscripts may take any of the following forms:

- **Research Article**: Full-length articles presenting important new research results. Research articles include an abstract, introduction, methods and results sections, discussion, and relevant citations. These are typically limited to 40 manuscript pages including citations, tables, and figures. Large data sets and other supplementary materials are welcome for inclusion in the online publication.

- **Review**: A comprehensive overview of an area of speech, language, or hearing sciences and/or disorders (i.e., systematic review or meta-analysis). Reviews should be accessible to knowledgeable readers not expert in the subject area. They should be prepared with the same rigor as a research article reporting specific results. These are typically limited to 40 manuscript pages including citations, tables, and figures.

- **Tutorial**: Educational expositions covering recent literature on topics of interest to clinicians and other scholars. These are typically limited to 40 manuscript pages including citations, tables, and figures.

- **Research Forum**: The purpose of a research forum (RF) is to provide a concentrated focus on a special topic deemed to be of high interest to the readership. An RF contains a series of empirical studies centering on a key aspect of speech, language, hearing, or swallowing science and/or disorders. RFs may also comprise a set of scholarly papers presented at a scientific conference.
  - A proposal for an RF must be approved for consideration by the journal editor prior to forum development. Pre-approval by an editor does not guarantee that any or all manuscripts submitted will be accepted for publication. The proposal should (1) provide a forum summary, (2) outline the probable manuscript titles and author lists, (3) state whether a prologue and/or epilogue is planned, and (4) designate one person, a forum coordinator, as the point of contact and coordinator of communications with forum authors.

- **Letter to the Editor**: Opinions about material previously published in the journal or views on topics of current relevance. A letter relating to work published in the journal will ordinarily be referred to the author(s) of the original item for a response, which may be published along with the letter. Letters are typically limited to 15 manuscript pages, including citations, tables, and figures.

- **Clinical Focus**: Articles that may be of primary clinical interest but may not have a traditional research format. Case studies, descriptions of clinical programs, and innovative clinical services and activities are among the possibilities.

- **Viewpoint**: Scholarly based opinion(s) on an issue of clinical relevance that currently may be neglected, controversial, related to future legislation, or could serve to update the readership on current thinking in an area.
Manuscript Style and Requirements

Style Manual
Authors are expected to follow the style specified in the *Publication Manual of the American Psychological Association* (6th edition).

Language Policies
OSLHA policy requires the use of nonsexist and person-first language in preparing manuscripts.

Page Limit
A guideline of 40 pages (including title page, abstract, text, acknowledgments, references, appendices, tables, and figures) is suggested as an upper limit for manuscript length. Longer manuscripts, particularly for critical reviews and extended data-based reports, will not be excluded from review, but the author(s) should be prepared to justify the length of the manuscript if requested to do so.

Peer Review
All manuscripts are peer reviewed, typically by at least two reviewers with relevant expertise, an issue editor (if applicable), and the journal editor. Correspondence between authors and editors is expected to be professional in tone. If correspondence is not conducted in a professional manner, an editor has the option to bring the matter before the OSLHA Directory of Technology and Publications and/or OSLHA’s Executive Council. After consultation with the Directory of Technology and Publications, the editor may terminate the peer review process for that submission. The author has the right to appeal to the OSLHA Directory of Technology and Publications and/or OSLHA’s Executive Council.

Authorship & Author Disclosures
During manuscript submission, answers to a number of disclosures will be required. The corresponding author:
- Affirms that all of the authors listed in the byline have made contributions appropriate for assumption of authorship, have consented to the byline order, and have agreed to submission of the manuscript in its current form
- Affirms that all applicable research adheres to basic ethical considerations for the protection of human or animal participants in research
- Affirms that there is no copyrighted material in the manuscript or includes a copy of the permission granted to reproduce or adapt any copyrighted material in the paper
- Affirms that the manuscript has not been previously published in the same, or essentially the same, form
- Affirms that the manuscript is not currently under review elsewhere. OSLHA prefers to publish previously unpublished material
- Discloses information about any previous public presentation of the data reported in the submitted manuscript, including at a scientific meeting or in conference proceedings, book chapters, websites, or related media
- Discloses any real or potential conflicts of interest that could be seen as having an influence on the research (e.g., financial interests in a test or procedure, funding by an equipment or materials manufacturer for efficacy research)

CALL FOR PAPERS
Submit your manuscript at any time by sending it to the Journal Editor: Laurie.sheehy@utoledo.edu or the Business Office oslhaoffice@ohioslha.org
Dear OSLHA Members,

I hope you enjoyed the articles that were in this issue of eHearsay.

OSLHA needs YOU!! Based on some of the 2019 membership survey results, it sounds like YOU want to be more involved in OSLHA. There are opportunities for you to get involved with eHearsay:

- Become a **Peer Reviewer**
  - Send your resume/CV to Laurie.Sheehey@utoledo.edu and let me if you have an area of expertise

- Become an **Author** or Co-Author
  - eHearsay publishes all types of manuscripts including: tutorials, reviews, clinical focus, viewpoint, research studies (even those with 1-5 participants).
  - OSLHA has also published student papers in the past. If you are a University professor and you require your students to write a paper, it may be of interest to our members. In years past we’ve had student papers re: meta-analysis (Case Western Reserve), group intervention in dementia (Baldwin-Wallace), English Language Learners (University of Cincinnati), Hearing status of children in developing nations (University of Toledo), Acceptance & Commitment Therapy for stuttering (University of Akron)

- Be a **Guest Editor**
  - If you have a topic you are passionate about (e.g., Head/Neck Cancer, Autism, Dyslexia, Fluency Disorders, Audiology Issues) and think you can get 4+ articles together on the subject, you can be a guest editor for a topic of your choosing.

Never stop learning because life never stops teaching. Be passionately curious. Make a difference in your world.

**Laurie M. Sheehy**
eHearsay Journal Editor

---

*Live as if you were to die tomorrow. Learn as if you were to live forever.*

Mahatma Gandhi