The Role of the SLP in Identifying Changes to the Swallow with Aging – Part 1

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As early as 50 years of age, individuals may begin to experience sensory and motor changes related to the swallow as a result of the natural aging process and continue to progress with age (Daggett, et al., 2006). These changes, which will be described in detail throughout this resource, are generally slow and mild; however, they may significantly reduce the efficiency of the swallow (Logemann et al., 2013). According to the 2012-2016 National Outcomes Measurement System (NOMS) report, 89.73 % of the speech-language pathologist’s (SLP) caseload across the acute, inpatient, outpatient, and skilled nursing settings consistent of patients 50 years of age and older and 60% of the SLPs caseload alone were individuals 70 years and older (ASHA, 2019). 59% of clinicians treating adults indicated that swallowing disorders were in the top five most common diagnoses they treat (ASHA, 2021). Given the prevalence of older adults treated by SLPs and the prevalence of swallowing conditions, clinicians should understand how to differentiate abnormal versus typical age-related changes in the swallow to ensure appropriate diagnostic and treatment interventions.

The content of this resource will focus on motor and sensory changes impacting the swallow in the aging population and aid clinicians in determining whether these changes are truly a disorder or instead, presbyphagia.

**WHAT IS PRESBYPHAGIA?**

McCoy and Desai (2018) define presbyphagia as “characteristic changes in the swallowing mechanisms of healthy older adults that result from the normal aging process.” (p. 15). These changes result due to anatomical and physiologic differences in the head and neck as well as sensory changes in age (Jones and Colletti, 2021). According to Humbert & Robbins (2018), “A healthy older adult’s swallow is not inherently impaired,” (p. 2). Despite these natural and expected changes, the swallow can remain functional (Namasivayam-MacDonald and Riquelme, 2019).

**ANATOMIC & PHYSIOLOGIC CHANGES TO THE SWALLOW SYSTEM WITH AGING**

According to Humbert and Robbins (2008), physiologic changes are the main factor in swallow changes related to aging when compared to the healthy young population (p. 2).

**Muscle atrophy**: Begins as early as 50 years of age (Aslam & Vaezi, 2013).

- **Sarcopenia**: Decline in muscle mass and the reduction in number and size of muscle fibers beginning as early as 50 years old (Ney, et al., 2009; Robbins, 1996).
- **Dental changes**: Deficits in mastication due to loss of or lack of dentition (Boyce & Shone, 2006). Loss of dentition can also have an impact on saliva production (Pedersen, et al., 2018). During mastication, the dental pressure onto the periodontal membrane triggers the brainstem’s saliva center through the trigeminal nerve and the more chewing force, the more saliva (Anderson & Hector, 1987). An increase in the number of mastication cycles and duration is expected when there are changes to dentition (Milford, et al., 2020).
- **Saliva changes**: According to Pedersen, et al., saliva plays an important role in the digestive process. Its presence can influence taste, aid in the breakdown and formation of the bolus, and facilitate the process of mastication and oropharyngeal swallow (2018). In order to taste food, the bolus must be mixed with saliva to stimulate taste receptor cells within the taste buds/papillae (Pedersen, et al., 2018).
  - Xerostomia – Due to a loss of saliva producing cells, older individuals have a decrease in salivary reserve (Brandt, 1999). Dry mouth may cause individuals to feel as though they cannot swallow despite functional swallow otherwise (Logemann, et al., 2013).

- **Labial changes**: In a study by Shune, et al., labial drop occurred earlier and lasted longer in anticipation of the bolus (2016). Decreased labial strength, mobility, and endurance of the lips in the older adult (Wohlert, 1996).

- **Lingual changes**:  
  - Atrophy, fatty infiltration, and decreased diameter of muscle fibers in the tongue (Bassler, 1987; Nakayama, 1991).
  - Decreased lingual strength, mobility, and endurance (Nakayama, 1991).
  - “Tipper” vs “dipper” swallow:
    - “Tipper swallow” - According to Dodds, et al, in the younger healthy population, a liquid bolus in the oral cavity it is contained to the top of the tongue with an immediate transfer posteriorly (1989).
    - “Dipper swallow” - In the older healthy swallow, the liquid bolus may be held on the floor of the mouth followed by sliding of the tongue forward to pick up the bolus to the surface of the tongue prior to initiation of the swallow (Dodds, et al., 1989).
    - According to Logemann, et al., the “dipper” swallow slows the oral phase when compared to the “tipper” swallow (2013).
  - Isometric (static) lingual pressure required for bolus propulsion from the mouth to the pharynx and through esophagus is significantly decreased due to muscle mass loss due to aging, or sarcopenia (Ney, et al., 2009).
  - Maximum lingual pressure (dynamic) remains sufficient in the older population; however, increased time is needed to obtain these (Robbins, et al., 1995; Nicosia, et al., 2000).

- **Masseter changes**:  
  - Prolonged muscle activity (Milford, et al, 2020) and reduced strength (McCullough, 2001).
  - In those 80 years and older, there is a significant increase in number of mastication cycles when compared to those 79 and younger (Milford, et al., 2020).

- **Swallow onset timing**:  
  - Age 50+: Delayed onset of hyoid burst upon the bolus’s arrival at the posterior angle of the mandible (Martin-Harris, et al.,2007). As a result, pooling of the bolus to the valleculae may be evident (Ney, 2009).
  - Age 65+: Significantly delayed with slowed laryngeal vestibular closure when compared to 45 years or younger (Tracy et al, 1989).

- **Sufficient anterior hyoid movement** for UES opening in individuals 80+ years; however, there is minimal to no reserve/movement beyond 1-2mm vs 8mm in those 21-30 years old (Logemann, et al., 2013).
  - Decreased hyolaryngeal elevation (Logemann, et al., 2013).
• **Pharyngeal and UES pressure** are, as opposed to lingual pressure, actually increased in healthy individuals over 60-year-old. It is suspected that this is due to the older individual’s attempts to compensate for a reduced UES opening by increasing the effort (McCullough, 2001).

• **Pharynx:** The pharynx is elongated and more dilated (McCoy & Richard, 2018).

• **Laryngeal changes**
  - The larynx lowers to the level of the sixth and seventh vertebrae (Michel et al., 1987).
  - Decreased flexibility due to laryngeal cartilage ossification (McCullough, 2001).
  - Thyroarytenoid muscle fiber (type 1, slow twitch) atrophy (Malmgren, et al., 1999).
  - Decreased bulk of the vocal cords (Leonard, 2020).
  - According to Karbiener et al. (2017), “age related atrophy of the laryngeal muscles – mainly the thyroarytenoid muscle (TAM) – leads to a glottal gap (p. 1).”
  - Presbylarynx, or typical age related “morphological changes”, have been found during laryngoscopy (Karbiener et al., 2017).

• **Respiratory changes:** Reduction in the elasticity of the lungs, vital capacity, inspiratory capacity, and expiratory reserve volume is evident with aging (McCullough, 2001).

• **Penetration of thin liquids begins to increase in frequency at 20 years old (Daggett, et al., 2006).** Penetration of foods and liquids in the older adult is deeper into the laryngeal vestibule and occurs more frequently (Robbins, et al., 1999).

**SENSORY CHANGES TO THE SWALLOW SYSTEM WITH AGING**

Along with motor changes to the swallow system with aging, individuals may experience changes in sensation. In older adults with a decline in swallow function due to the aging process, changes in sensation may be one of the first symptoms to present (Etter & Madhavan, 2020). Each of these changes discussed may or may not influence the efficiency or safety of the swallow but may have ill effect on the individual’s quality of life:

• **Olfaction (smell) and gustation (taste)** – In individuals 53-59 years of age, olfactory impairment was reported with the prevalence increasing with age to 29.2% in individuals 70-79 and to 62.5% in those ages 80-97 (Murphey, et al., 2002). Furthermore, Kondo, et al. (2021) indicate olfactory dysfunction increases at the age of 60 in males and 70 in females with more males affected than females. In addition to gender, ethnicity may influence olfactory decline. Dong et al. (2017) reported that the incidence of anosmia (loss of the sense of smell) in the older population is higher in black people compared to white people. Pinto et al. (2015) also reported that olfaction in African Americans deteriorates more rapidly than in Whites. According to Boyce and Shone (2006), “gustatory dysfunction may indeed be related to the normal ageing process” (p. 239) this may be due to a decrease in olfactory receptors and receptor cell death. Taste is a contributing factor in the reward value of food.

• **Vision/Proprioception** – With aging, cellular changes occur within the ocular system that can lead to changes in visual acuity/clarity, peripheral visual field function, the contrast between object and the background, perception of color, and slowed speed of processing (Erdinest et al., 2021). These visual-perceptual changes can impact anticipation of bolus taste (e.g., color is crucial in providing visual cues for sensory properties such as taste and flavor (Spence, 2015a). Impaired proprioception and ability to recognize the size and weight of the bolus can also be impacted as a result of these sensory changes (McCoy & Desai, 2018).
• **Audition** – Presbycusis is defined as the gradual loss of hearing with age. It is most commonly related to changes to the inner ear, middle ear, or to the neural pathways from the ear to the brain. In the United States, hearing loss affects one in three people aged 65-74 and almost half of those 75 and older (NIDCD, 2018). Sound plays an important role in one’s ability to identify textural properties and flavor of food/liquids (e.g., crunchy, fizzy, etc.); however, the level of involvement is not yet fully understood. Sound is also crucial in determining the amount of pleasure gained from an eating or drinking experience (Spence, 2015b). For example, consider the sound heard when milk is poured into a bowl of Kellogg’s Rice Krispies® and how the sensory system is already beginning to process the auditory information as part of the anticipatory or pre-oral phase of the swallow.

• **Tactile** – There may be deficits in touch sensation to the cheeks, lips, and tongue in healthy aging individuals (Venkatesan et al., 2015). The aging individual may present with difficulty in elimination of residue due to decreased tactile awareness (Madhavan & Etter, 2021). Individuals may also experience decreased sensitivity and sensation to the vocal folds, pharynx, and larynx (Leonard, 2020; Aviv et al, 1994).

**SENSORY MOTOR FEEDBACK LOOP CHANGES TO THE SWALLOW SYSTEM WITH AGING**

Neurological changes are also normal with aging (McCullough, 2001). According to Madhavan and Etter (2021), there may be changes in the efficiency of the communication/feedback loop in terms of receiving, transmitting, and processing afferent (sensory) information. This might include slowing of neural transmission/communication, cellular loss, and damage (McCullough, 2001). If there are changes to the sensory component of this feedback loop, the motor plan can fail to adapt, resulting in changes in the swallow (e.g., a delayed swallow onset). These actions take place across three levels of the peripheral and central nervous systems (Madhavan & Etter, 2021):

1. The peripheral nervous system (PNS) provides feedback to aid in organization and in developing a response to the specific bolus presented. Changes in sensation (e.g.: smell, taste, touch) may impact the ability to inform the motor system on how to react to a bolus. More sensory input and time may be necessary to promote a sufficient neurological motor response from a bolus (McCullough, 2001).
2. Subcortical control is then initiated where previous experiences shape motor patterns (e.g., laryngeal elevation, adduction, pharyngeal constriction, etc.).
3. The descending cortical pathways adapt the motor plans and swallow activity based on the sensory feedback that has been processed.

(Flowchart created and adapted by authors based on information from Madhavan & Etter, 2021)
Changes in any of the above three areas (PNS, subcortical control and/or descending cortical pathways) can result in changes to the swallow.

**CULTURAL CONSIDERATIONS**

Cultural consideration must be discussed when applying the research to current patient population and person-centered care. Many of the research studies summarized within this resource provided details regarding age and gender however information regarding race and/or ethnicity was not often specified. In areas where specific details were provided regarding gender, race, ethnicity and neurodiversity research methods and study samples ranged from single case studies, self-assessments, double blind, human test subject’s vs animal and population-based studies. When considering age-related changes in swallowing it is crucial to account for the individuals wants and needs as well as the individuals cultural and personal history.

If you would like more information or insight regarding cultural considerations, please consider joining the MedSLP Collective’s Diversity Collaboration Committee (DCC).

**CONCLUSION**

Part one of this resource has discussed the specifics of presbyphagia including normal aging process, anatomy, physiology and sensory impact to swallowing. A clinician’s solid foundation/understanding of this information is crucial for best practice and proper care of the aging adult in the medical setting. The following part of this resource will expand on how presbyphagia could possibly worsen to the clinical diagnosis of dysphagia.
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