

## Changes in Normal Swallow with Age

As we normally age, swallow changes in the following ways:

### A. Primary Effects of Normal Aging - Effects of Age Alone in HEALTHY Elderly

#### 1. The 60 – 80-year-old

##### a. Timing of the Swallow

- 1) Oral transit times slightly but significantly longer in older adults (.5-.6 sec). Tipper (tongue tip against alveolar ridge at initiation of swallow) vs. dipper (tongue tip behind lower teeth at initiation of swallow) swallow types - Elderly more often dippers
- 2) Pharyngeal delay times slightly but significantly longer in older adults (.5-.6 sec)
- 3) Pharyngeal wall contraction inconsistently found to be slower
- 4) Reduced tongue pressure

##### b. Safety and Efficiency of the Swallow

- 1) Penetration occurs more frequently
- 2) Aspiration occurs no more frequently in the elderly
- 3) Residue is generally only slightly greater (2-3%) in the elderly than in younger adults

#### 2. 80+ year-olds - Range and pattern of pharyngeal movements during the swallow in 80-year-olds are different from younger adults which increase the older adult's risk of dysphagia as the result of illness and subsequent general weakness.

##### a. Reduced reserve - especially in men

- 1) Hyoid & laryngeal maximum vertical movement significantly reduced in the elderly (over age 80)
- 2) Hyoid and laryngeal movements up to the time of cricopharyngeal opening virtually identical in young adults and elderly patients

##### b. Reduced flexibility

- 1) Cricopharyngeal opening durations across volumes reduced in the elderly
- 2) Cricopharyngeal opening diameter across volumes reduced in the elderly
  - a) Timing similar to 60-80-year-olds
  - b) Safety and efficiency of swallow unchanged

##### c. Range of motion exercises may improve reserve and flexibility in otherwise normal, healthy elderly.

#### 3. Conclusions

- a. Healthy older adults exhibit highly safe and efficient swallow
- b. Illness causing extreme weakness may cause dysphagia in otherwise normal over 80-year-olds

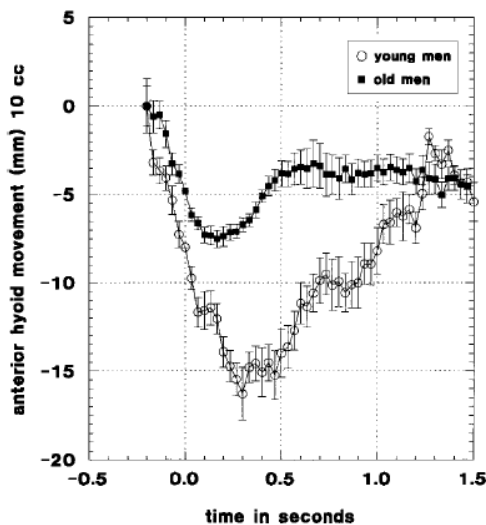
### B. Aging and Swallow in Normal Men and Women [Logemann, J. A., Pauloski, B. R., Rademaker, A. W., & Kahrilas, P. J. (2002). Oropharyngeal swallow in younger and older women: Videofluoroscopic analysis. *Journal of Speech, Language, and Hearing Research*, 45, 34-444.]

1. Healthy women have a more sensitive cough reflex than do healthy men. The reasons for this significant gender difference remain to be elucidated, but may involve a heightened sensitivity, in women, of the sensory receptors within the respiratory tract that mediate cough and more sensory receptors. Cough threshold is significantly lower in female subjects. Dicipinigaitis, P. V., & Rauf, K. (1998). The influence of gender on cough reflex sensitivity. *Chest*, 113(5), 1319-1321.
2. With age, normal men lose more range of motion than women. This eliminates muscular reserve contributing to reduced swallowing function.

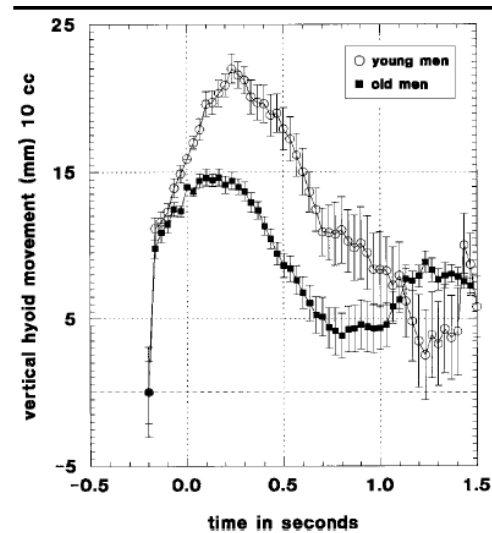
**Changes in Swallow Mechanics with Normal Aging  
Maximal Laryngeal and Hyoid Elevation (mm) on 1 ml Swallows**

	Laryngeal Movement (mm)		Hyoid Movement (mm)	
	Young	Old	Young	Old
<b>Men</b>	24.22	21.77	19.83	11.59
<b>Women</b>	16.89	23.07	9.88	10.37

Logemann, J. A., Pauloski, B., Rademaker, A., Colangelo, L., Kahrilas, P., & Smith, C. (2000). Temporal and biomechanical characteristics of oropharyngeal swallow in younger and older men. *Journal of Speech, Language, and Hearing Research*, 43, 1264-1274.



**Plots of mean anterior hyoid movement** at 1/30th of a second intervals on the two 10 cc liquid swallows of the 8 younger men and 8 older men. Time 0 represents the onset of cricopharyngeal (upper esophageal sphincter) opening.



**Plot of averaged vertical hyoid movement** at 1/30th of a second intervals on 10 cc liquid swallows for the 8 younger men and 8 older men. Time 0 represents the first frame showing cricopharyngeal (upper esophageal) opening.

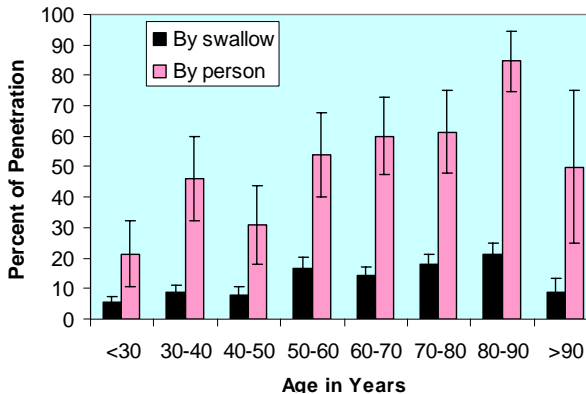
3. Teach normal older men, especially men over 80, exercises to build muscular reserve and range of motion.
  - a. Shaker exercise [Shaker, R., Easterling, C., Kern, M., Nitschke, T., Massey, B., Daniels, S., Grande, B., Kazandjian, M., & Dikeman, K. (2002). Rehabilitation of swallowing by exercise in tube-fed patients with pharyngeal dysphagia secondary to abnormal UES opening. *Gastroenterology*, 122, 1314-1321.]

Shaker, R., Kern, M., Bardan, E., Taylor, A., Stewart, E.T., Hoffmann, R.G., Arndorfer, R.C., Hofmann, C., & Bonnevier, J. (1997). Augmentation of deglutitive upper esophageal sphincter opening in the elderly by exercise. *American Journal of Physiology*, 272 (6 Pt 1), G1518-G1522.

- b. Mendelsohn maneuver [Kahrilas, P.J., Logemann, J.A., Krugler, C., & Flanagan, E. (1991). Volitional augmentation of upper esophageal sphincter opening during swallowing. *American Journal of Physiology*, 260 (Gastrointestinal Physiology (Gastrointest Liver Physiol), 23), (G450-456).]
- c. Tongue base exercises
  - 1) Gargle and hold tongue base position for 2 seconds.
  - 2) Pull tongue back and hold tongue in posterior position for 2 seconds.
  - 3) Yawn and hold tongue in retracted position for 2 seconds. [Veis, S., Logemann, J.A., & Colangelo, L.A. (2000). Effects of three techniques on maximum posterior movement of tongue base. *Dysphagia*, 15, 142-145.]

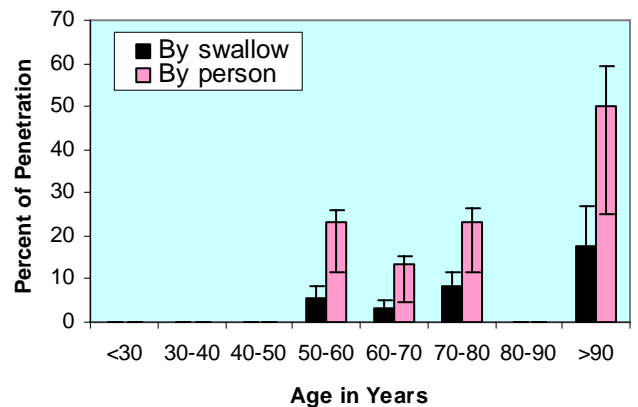
Penetrations occur significantly more frequently after age 50 and thick viscosities only penetrated in subjects over 50 years of age. For persons under 50, 7.4% of swallows exhibited penetration while for people over 50, 16.8% of swallows showed penetration.

Figure 1.



Percent (SE) of penetration on thin liquids of various volumes by age, presented by swallow, and person.

Figure 2.



Percent (SE) of penetration on thicker foods (pudding, cookie, apple) by age, presented by swallow, and person.