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# Effect of Taste Stimuli on Swallowing Function in Persons with Traumatic Injuries

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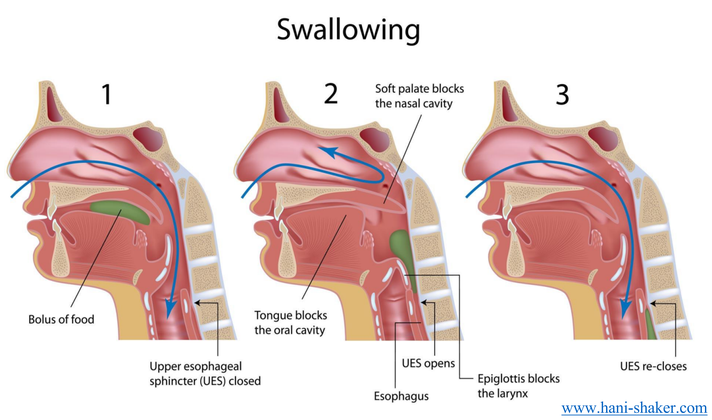
## Background

**Extremely sour liquids improve swallowing mechanics in persons with swallowing disorders (dysphagia) due to stroke or head and neck cancer** (Logemann et al., 1995; Pelletier & Lawless, 2003).

- This has not been explored in patients with traumatic injuries.
- Traumatic injuries can lead to neurological as well as structural impairments, so it is possible that taste intervention might also have beneficial effects on swallowing in this population.
- The motor response has been shown to adapt to the stimulus present (Dietsch et al., 2016).
- The effects of pleasant taste stimuli (as compared to strong sour boluses) has not been tested.

**Swallowing requires coordination of multiple neuromuscular systems to direct a bolus of food or liquid towards the digestive system and away from the respiratory tract.**

- The inability to eat or drink is detrimental to the recovery process.




## Purpose and Hypothesis

**Purpose:** Examine the effects of three different taste profiles (plain, sweet-sour, and sour) on the swallowing capability of persons with dysphagia due to traumatic injuries. The goal is to explore alternative and complementary ways to treat swallowing impairments as efficiently and effectively as possible.

**H1:** Pharyngeal residue (the amount of food/liquid left in the throat after the swallow) will vary across the different tastes.

**H2:** The degree to which the bolus enters the airway (penetration/aspiration), as opposed to the esophagus, will vary by taste stimuli.

## Materials and Method

**Subjects**

- Traumatically injured young adults with dysphagia under another research protocol (N=26 swallows from 9 participants).

**Procedures**

- Quantitative data will be extracted from a pool of de-identified videofluoroscopic (moving x-rays) swallowing studies.
- Identification of anatomical landmarks and residue at different stages of a full swallow of 5cc boluses, each with one of three custom mixed taste profiles.
- Description of degree of any airway penetration using a standardized scale.

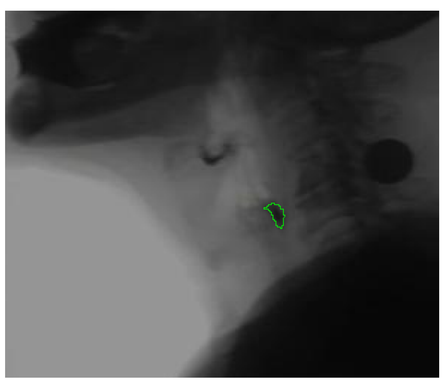
**Outcome Measures**

- An 8 point penetration/aspiration scale (PAS) was used to rate each swallow. Ratings of 2-5 reflected penetration with varying degrees of severity (regarding depth of penetration and whether it was cleared/not cleared), and ratings of 6-8 indicated aspiration with varying degrees of patient awareness and response. A rating of 1 was used if no airway penetration occurred (Rosenbek, 1996).
- A Normalized Residue Ratio Scale (NRRS) calculated the amount of residue in each pharyngeal space relative to the anatomical space and the individual's body height (Pearson, 2013).

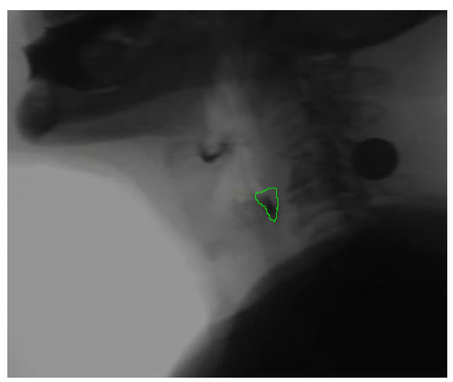
**Analysis**

- ImageJ Software was used for residue ratings by outlining the residue and then outlining the anatomical space that the residue occupied.
- Excel macros used results obtained from ImageJ to calculate the ratio of the residue to the associated anatomical space and an anatomical scalar to account for participant height differences.
- Data were compared using a repeated-measure analysis of variance (SPSS) to assess differences in outcomes of NRRS and PAS levels across the different tastes.

## Measuring Piriform Residue and Piriform Space for NRRS



Outline of residue in the piriform



Outline of piriform cavity

## Results

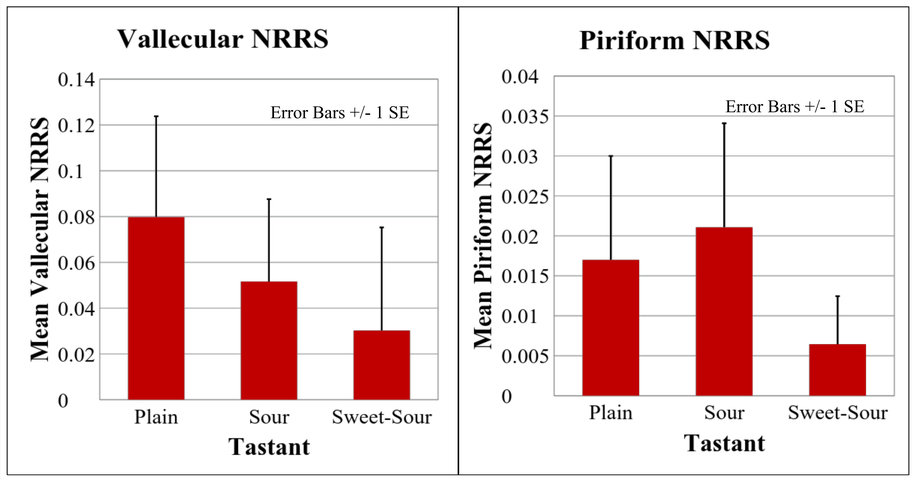
**H1 was supported**

- The tastants affected the amount of residue that remained within the vallecular and piriform spaces on each trial
- Significance of vallecular NRRS $p$=0.043
- Significance of piriform NRRS $p$=0.039

**H2 was not supported**

- The degree to which the bolus entered the airway (penetration/aspiration), as opposed to the esophagus, did not vary by taste stimuli.
- Significance of PAS $p$=0.462
- This could be from the limited number of participants or the use of an ordinal scale compared to a continuous scale.

**PAS was not predictive of residue ($p$=0.627-0.932)**




## Conclusion

Pharyngeal residue did vary across the different tastes. However, the degree of penetration/aspiration from each swallow did not appear to have a direct relationship with either the tastant type nor the residue left behind. The taste stimuli tested has immediate benefits for some aspects of dysphagia. Further testing of additional taste profiles is warranted.

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