International Journal of
Physical Medicine & Rehabilitation

Shinjo et al., Int J Phys Med Rehabil 2013, 1:4
DOI: 10.4172/2329-9096.1000133

Research Article Open Access

Effects of Posture on Subjective Swallowing Difficulty during Screening Tests for Dysphagia

Yoshitaka Shinjo[1], Ayako Okitsu[1], Ikumi Ukeda[1], Ayako Miyagi[1], Kazuhisa Domen[2] and Tetsuo Koyama[1,2]*

[1]*Department of Rehabilitation Medicine, Nishinomiya Kyoritsu Neurosurgical Hospital, 11-1 Imazu-Yamanaka-cho, Nishinomiya, Hyogo, Japan*
[2]*Department of Physical Medicine and Rehabilitation, Hyogo College of Medicine, 1-1 Mukogawa-cho, Nishinomiya, Hyogo, Japan*

Abstract

Objective: To assess how postural adjustment affects subjective swallowing difficulty during swallowing rehabilitation.

Subjects: Sixteen normal volunteers.

Design: Three screening tests – repetitive saliva swallowing, water swallowing, and food swallowing – were performed in 7 positions: upright, backrest, slouching, reclining 60° supine, reclining 60° lateral, reclining 30° supine, and reclining 30° lateral. Subjective swallowing difficulty was assessed using a visual analogue scale (VAS; 0 - 10).

Results: Patients indicated minimum difficulty while upright, and responses showed that the further from perpendicular was the reclining angle, the more difficulty they reported in swallowing. During food swallowing in supine positions, when reclining 60° VAS score was 3.06, and at 30° was 4.62. In lateral positions, VAS score increased along the same lines. Results were similar for all three swallowing tests.

Conclusion: Postural adjustment induced considerably higher subjective swallowing difficulty. When imposing postural adjustment, clinicians should be aware of the subjective difficulty that patients have in swallowing.

Keywords: Bedside; Feeding; Meal; Swallowing

Abbreviations: VAS: Visual Analogue Scale

Introduction

As in most other advanced countries, in Japan the rapidly increasing geriatric population has become a serious social issue. Within the geriatric population, swallowing can be a major therapeutic concern. For example, 30%–50% of stroke patients have trouble swallowing (dysphagia) [1], and half of Parkinson's disease patients show similar problems [2]. Dysphagia is also a serious medical condition in late-stage Alzheimer's disease [3]. To treat dysphagia, diet modification (e.g., use of food pastes) and postural adjustment (e.g., reclining) are commonly advised in Japan [4,5].

Swallowing has three phases: oral, pharyngeal, and esophageal [6]. In the oral phase, the food masticated, that is, chewed and mixed with saliva, and then formed into a bolus of a size that can easily pass into the pharynx, a shared pathway leading to discrete entrances to the respiratory (trachea) and digestive (esophagus) systems. The pharyngeal phase begins when an involuntary reflex moves the food bolus into the pharynx. In an upright body posture, the esophagus is located postero-dorsal to the trachea. When the body is reclining, the relative position of the esophagus shifts to beneath the trachea. In this way, postural adjustment is thought to be effective against aspiration during swallowing because gravity helps the food bolus to pass easily though esophagus when the body is reclined [5,7,8].

Swallowing while reclining, however, is not something to which patients are previously habituated. Thus, they may find it more difficult to swallow when not sitting normally. No studies have yet touched upon this simple but important issue. Consequently, we designed a study to assess subjectively reported swallowing difficulty in healthy individuals during the kinds of postural adjustment that may be imposed during therapy.

Methods

Sixteen healthy volunteers (age 22–37 y. o, median 29 y. o; 7 female, 9 male; all right-handed) participated in this study. Each gave written informed consent, and all procedures were approved by our Institutional Review Board.

The subjects underwent three types of swallowing tests commonly used to screen for dysphagia: a) repetitive saliva-swallowing test, in which the subject was instructed to swallow saliva as many times as possible during a 30 s period; b) water-swallowing test, in which the subject was instructed to swallow after cold water (3 ml) was spooned into the mouth; and c) food-swallowing test, in which the subject was instructed to swallow after food (4 g of custard pudding) was spooned on to the dorsum of the tongue [9,10]. These tests are widely used in rehabilitation medicine in Japan [10]. To evaluate the effects of postural adjustment on swallowing, we performed these three tests in seven positions: 1) upright; 2) sitting with a backrest; 3) slouching; 4) reclining 60° supine; 5) reclining 60° lateral (left-side up) ; 6) reclining 30° supine; and 7) reclining 30° lateral (left-side up) (Figure 1). The order of the three types of swallowing tests was counterbalanced across subjects, and seven postures were randomly assigned within the same type of swallowing test. In all, each subject underwent a total of 21 trials.

For each trial, subjective swallowing difficulty was assessed by scoring a visual analogue scale (VAS; Figure 2) [11,12]. This method of evaluation is commonly used to assess the intensity of sensations (e.g. pain, unpleasantness, itching, and fatigue), and its validity and reliability are established [13-15]. In this study, we used 5 cm lines

***Corresponding author:** Tetsuo Koyama, Department of Rehabilitation Medicine, Nishinomiya Kyoritsu Neurosurgical Hospital, 11-1 Imazu-Yamanaka-cho, Nishinomiya, Hyogo, Japan, Tel: +81-798-33-2211; Fax: +81-798-33-2438; E-mail: ytkoyama@bd6.so-net.ne.jp

Received April 28, 2013; **Accepted** May 18, 2013; **Published** May 20, 2013

Citation: Shinjo Y, Okitsu A, Ukeda I, Miyagi A, Domen K, et al. (2013) Effects of Posture on Subjective Swallowing Difficulty during Screening Tests for Dysphagia. Int J Phys Med Rehabil 1: 133. doi:10.4172/2329-9096.1000133

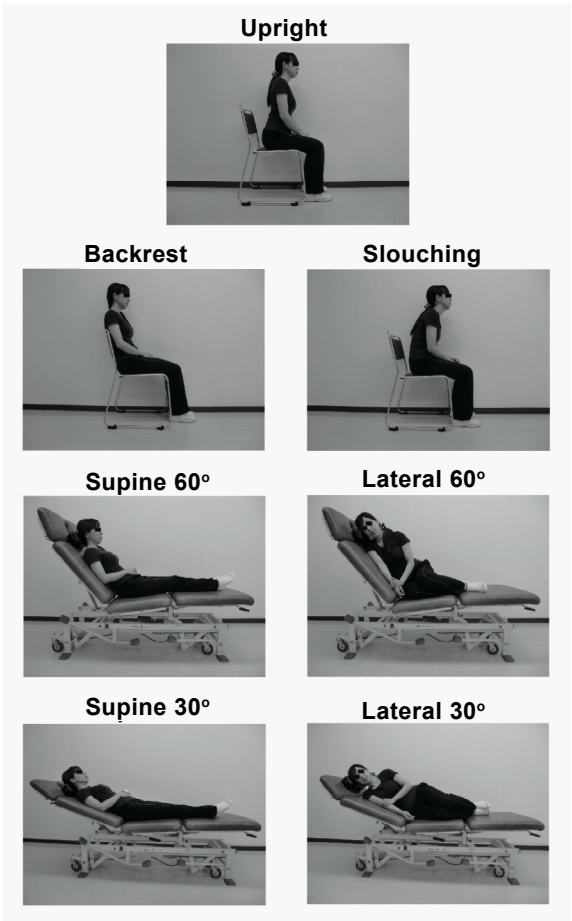

Figure 1: Postural adjustment. Each member of our test population underwent three swallowing tests in each of these postures.

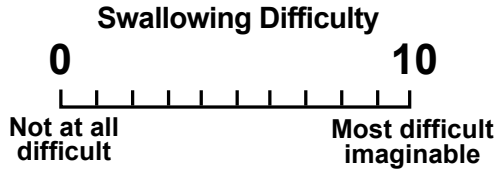

Figure 2: Visual analogue scale.

printed on paper. The lowest end was labeled "Not at all difficult," and the maximum end was "The most difficult imaginable."

Besides subjectively reported swallowing difficulty, the examiners (Y.S. and T.K., the first and the senior authors) observed and evaluated swallowing difficulty using the following conventional protocols for these three tests [10]. The water-swallowing test was scored one for inability to swallow through to five for complete swallowing. Similarly, in the food-swallowing test, severe food aspiration was scored as one, with relative scores up to five, which was scored when there was no sings of aspiration: cough or voice changes or both were considered signs of potential aspiration [16,17]. Besides, during the repetitive saliva-swallowing test, the number of swallows was recorded. A previous study has reported that normal subjects, during the repetitive saliva-swallowing test, are able to swallow more than 3 times within 30 seconds [9].

To bring to light the effects of posture on swallowing, data were statistically analyzed using multivariate analysis of variance repeated within subjects (Greenhouse-Geisser epsilon). A p value of <0.05 was considered statistically significant. All analyses were done using a statistical software package JMP ver 5.1 (SAS, Cary, NC).

Results

For all three types of swallowing test, test participants reported greater subjective swallowing difficulty when posture was adjusted away from upright (Figure 3; Table 1). Since no signs of coughing or voice change were apparent during any of the three types of test, we attributed reports of swallowing difficulty to subjective sensation rather than to physiological changes. Since postural changes were randomized, order effects (e.g. habituation and/or fatigue) were minimized in the overall data. VAS scores were lowest for upright posture, slightly increasing for backrest and slouching postures. Scores consistently increased as the angle from the perpendicular increased (Figure 3). For example, during the supine posture food-swallowing tests, swallowing was scored at 3.06 when reclining at 60° and then increased to 4.62 when reclining at 30°. A similar pattern was apparent in lateral recline: the VAS score increased from 3.75 at 60° to 4.81 at 30°. Subjective scores for swallowing difficulty similarly correlated for all three swallowing tests (Figure 3).

By contrast with subjectively reported swallowing difficulty, no evidence of swallowing difficulty related to postural change was objectively observed and rated using conventional protocols. Analysis revealed no statistically significant changes in the number of swallows during the repetitive saliva-swallowing tests (Figure 3; Table 1).

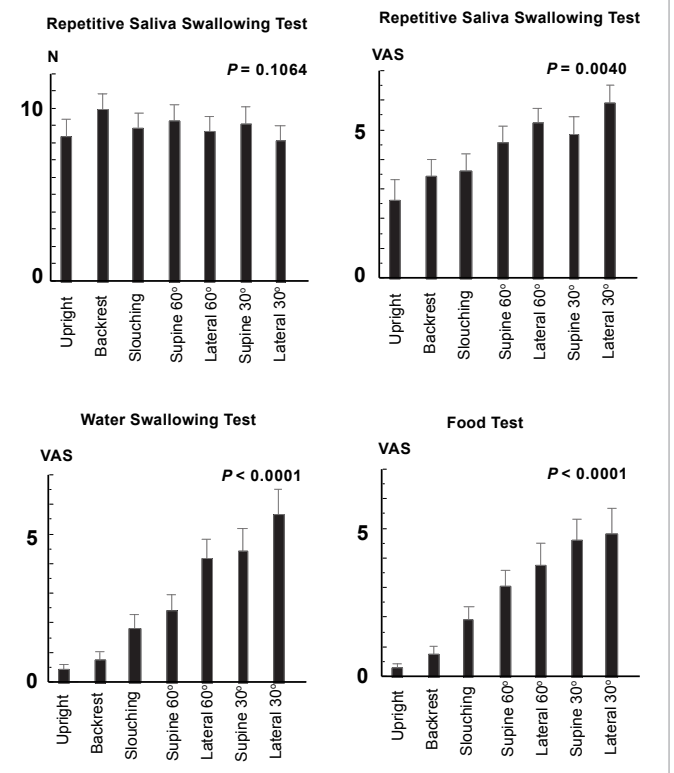

Figure 3: Number of swallows and subjective scores for swallowing difficulty in different postures (bars show mean and lines show standard error, N = 16 subjects). N, number of swallows during repetitive saliva-swallowing test; VAS, visual analogue scale.

Test	Greenhouse-Geisser epsilon	Exact *F* value	Degree of freedom	p value
RSST (N)	0.4240	2.2569	2.5441, 38.161	0.1064
RSST (VAS)	0.5401	4.8657	3.2408, 48.612	0.0040
WST	0.5270	20.1507	3.1622, 47.433	<0.0001
FT	0.4991	14.5658	2.9945, 44.917	<0.0001

Abbreviations: FT: Food-swallowing Test; N: number of swallows; RSST: Repetitive Saliva-Swallowing Test; VAS: Visual Analogue Scale; WST: Water-Swallowing Test

Table 1: Statistical analysis results.

Similarly, postural adjustment did not affect objective scores for water or food swallowing: all subjects scored 5 (complete swallowing) for all these trials.

Discussion

Postural adjustment is a basic therapeutic strategy used when rehabilitating patients with dysphagia in Japan [4,5]. No studies, however, have yet systematically assessed perceived swallowing difficulty during postural adjustment. In this study, normal volunteers reported subjective swallowing difficulty in various postures during three types of screening test. When reclining, they subjectively scored (VAS) difficulty in the range of about 3.0–5.0 (Figure 3), which could be exhausting. It is worth noting that these VAS scores were obtained during short screening tests (several to 30 s) [10]. During hospital meal times, patients with severe illness are often fed in reclining postures and consequently experience swallowing discomfort for much longer periods (10–30 min). Before imposing postural adjustment, clinicians should be aware of our experimentally observed findings for subjective swallowing difficulty. If fed while reclining, discomfort may lead patients to stop eating before ingesting an adequate amount of food.

In clinics, there are special circumstances (e.g., decubitus, burns, and fractures), patients are encouraged to maintain lateral postures. As our data show, swallowing in lateral postures was more difficult. While eating, such a posture should, if possible, be avoided. Even when sitting, our subjects felt least difficulty swallowing when in an upright posture. This finding confirms, at least for healthy normal subjects, that upright is the most comfortable eating posture.

In sharp contrast to subjectively reported swallowing difficulties, postural adjustment minimally affected objectively rated swallowing functions. For water- and food-swallowing tests, we employed the five-grade scale commonly used in conventional protocols [10]. In our population of healthy young volunteers, such a scale might not be sensitive enough to detect all the changes induced by postural adjustment. For example, a previous study using electromyography reported that postural adjustment prolonged the duration of swallowing apnea [10], suggesting other possible effects of postural adjustment [18].

This study has a number of limitations. First, the sample size was relatively small (N=16). Even so, data analysis was able to detect statistically significant differences (Figure 3; Table 1). Second, all subjects were young, healthy volunteers (staff of our hospital). By contrast, in clinical practice, it is older patients who tend to suffer from dysphagia [19,20]. To obtain data more immediately relevant to clinical situations, further studies need to include older individuals. Third, the present study focused on subjective difficulty. Previous studies using videofluorography to investigate physiological changes have revealed that postural adjustment affects the oral and pharyngeal phases of swallowing [21,22]. Further studies are needed to fully clarify the relationship between physiological changes and subjective difficulty during swallowing. Fourth, in this study we determined the presence of aspiration by evidence of cough or voice changes during or following swallowing. However, clinically, the absence of these signs is not an indicator of swallowing integrity in a dysphagic population, where silent aspiration (i.e. aspiration without a cough response or voice changes) is possible [17]. Because our subjects were young, healthy volunteers, the presence of silent aspiration is unlikely.

In conclusion, postural adjustment can affect subjective difficulty in swallowing. The difficulty was considerably higher (VAS 3.0–5.0) in reclining positions. Clinicians should be aware of the subjective difficulty patients may have with swallowing in increasingly reclines positions.

Acknowledgments

A part of this study was supported by a Grand-in-Aid for Scientific Research (B), the Japan Society for the Promotion of Science (KAKENHI [25282168]).

References

1. Oto T, Kandori Y, Ohta T, Domen K, Koyama T (2009) Predicting the chance of weaning dysphagic stroke patients from enteral nutrition: a multivariate logistic modelling study. Eur J Phys Rehabil Med 45: 355-362.
2. Ali GN, Wallace KL, Schwartz R, DeCarle DJ, Zagami AS, et al. (1996) Mechanisms of oral-pharyngeal dysphagia in patients with Parkinson's disease. Gastroenterology 110: 383-392.
3. Kalia M (2003) Dysphagia and aspiration pneumonia in patients with Alzheimer's disease. Metabolism 52: 36-38.
4. Baba M, Saitoh E, Okada S (2008) Dysphagia rehabilitation in Japan. Phys Med Rehabil Clin N Am 19: 929-938.
5. Inagaki D, Miyaoka Y, Ashida I, Yamada Y (2009) Influence of food properties and body position on swallowing-related muscle activity amplitude. J Oral Rehabil 36: 176-183.
6. Lang IM (2009) Brain stem control of the phases of swallowing. Dysphagia 24: 333-348.
7. Inagaki D, Miyaoka Y, Ashida I, Ueda K, Yamada Y (2007) Influences of body posture on duration of oral swallowing in normal young adults. J Oral Rehabil 34: 414-421.
8. Nakayama E, Tohara H, Hiraba H, Sanpei R, Wakasa H, et al. (2013) Effects of reclining posture on velopharyngeal closing pressure during swallowing and phonation. J Oral Rehabil 40: 450-456.
9. Tamura F, Mizukami M, Ayano R, Mukai Y (2002) Analysis of feeding function and jaw stability in bedridden elderly. Dysphagia 17: 235-241.
10. Tohara H, Saitoh E, Mays KA, Kuhlemeier K, Palmer JB (2003) Three tests for predicting aspiration without videofluorography. Dysphagia 18: 126-134.
11. Rhodus NL, Moller K, Colby S, Bereuter J (1995) Dysphagia in patients with three different etiologies of salivary gland dysfunction. Ear Nose Throat J 74: 39-48.
12. Wallace KL, Middleton S, Cook IJ (2000) Development and validation of a self-report symptom inventory to assess the severity of oral-pharyngeal dysphagia. Gastroenterology 118: 678-687.
13. Rosier EM, Iadarola MJ, Coghill RC (2002) Reproducibility of pain measurement and pain perception. Pain 98: 205-216.
14. Elman S, Hynan LS, Gabriel V, Mayo MJ (2010) The 5-D itch scale: a new measure of pruritus. Br J Dermatol 162: 587-593.
15. Wikström I, Arvidsson B, Nilsson K, Roos E, Jacobsson LT (2009) Reliability, validity and responsiveness of a new leisure index: the Patient-Specific Leisure Scale (PSLS). Musculoskeletal Care 7: 178-193.

16. Clavé P, Arreola V, Romea M, Medina L, Palomera E, et al. (2008) Accuracy of the volume-viscosity swallow test for clinical screening of oropharyngeal dysphagia and aspiration. Clin Nutr 27: 806-815.

17. Wakasugi Y, Tohara H, Hattori F, Motohashi Y, Nakane A, et al. (2008) Screening test for silent aspiration at the bedside. Dysphagia 23: 364-370.

18. Ayuse T, Ayuse T, Ishitobi S, Kurata S, Sakamoto E, et al. (2006) Effect of reclining and chin-tuck position on the coordination between respiration and swallowing. J Oral Rehabil 33: 402-408.

19. Tanner DC (2010) Lessons from nursing home dysphagia malpractice litigation. J Gerontol Nurs 36: 41-46.

20. Quagliarello V, Juthani-Mehta M, Ginter S, Towle V, Allore H, et al. (2009) Pilot testing of intervention protocols to prevent pneumonia in nursing home residents. J Am Geriatr Soc 57: 1226-1231.

21. Larnert G, Ekberg O (1995) Positioning improves the oral and pharyngeal swallowing function in children with cerebral palsy. Acta Paediatr 84: 689-692.

22. Briani C, Marcon M, Ermani M, Costantini M, Bottin R, et al. (1998) Radiological evidence of subclinical dysphagia in motor neuron disease. J Neurol 245: 211-216.