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

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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 onto 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 perpendicular to each VAS score.
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).
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.

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References


Table 1: Statistical analysis results.

<table>
<thead>
<tr>
<th>Test</th>
<th>Greenhouse-Geisser epsilon</th>
<th>Exact F value</th>
<th>Degree of freedom</th>
<th>p value</th>
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<td>RSST (N)</td>
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<td>2.5441, 38.161</td>
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<td>RSST (VAS)</td>
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<td>3.2408, 48.612</td>
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<td>WST</td>
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<td>20.1507</td>
<td>3.1622, 47.433</td>
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<tr>
<td>FT</td>
<td>0.4991</td>
<td>14.5658</td>
<td>2.9945, 44.917</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

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


