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Editorial

Differences between drinking and eating from the viewpoint of dysphagia rehabilitation

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Dysphagia rehabilitation in Japan

Dysphagia rehabilitation holds a very prominent position in rehabilitation medicine in Japan. The Japanese Society of Dysphagia Rehabilitation (JSDR) was established in 1995 as a "conference" and became a "society" from 1996. In 2020, the number of members exceeded 14,000. Among the members of the JSDR speech-language-hearing therapists account for one third, followed by dentists. Many patients with dysphagia have problems not only with swallowing but also with the meal itself. Therefore, many medical professionals are expected to be involved including physicians, dentists, nurses, speech-language-hearing therapists, physical therapists, occupational therapists, dental hygienists, nutritionists, and medical social workers. However, this is not possible in practice, so the role of transdisciplinary teamwork must be adjusted to satisfy the patient's needs and problems [1]. Thus, in a transdisciplinary team the role of medical professionals changes depending on the patient's needs. We require a wide range of common fundamental knowledge beyond the traditional job role. The JSDR has a certification system and 3,211 people are currently certified, with the largest number being speech-language-hearing therapists, followed in order by dentists, nurses, and physicians. The certified members who have passed the examination after taking the e-learning system are expected to work beyond their traditional roles.

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Drinking and eating

The main difference between drinking and eating is the absence or presence of mastication. Traditionally, the four-stage sequence model is advocated for swallowing [2, 3] (Figure 1). In the past, liquid was used for the bolus to minimize the exposure time due to the large irradiation dose by X-ray fluoroscopy. The four-stage sequence model divides swallowing into the oral preparatory, oral propulsive, pharyngeal, and esophageal stages. In the oral preparatory stage, a bolus is collected in the oral cavity and placed in a swallow-ready position. The isthmus of fauces is closed by the tongue and soft palate. The isthmus of fauces opens and the bolus is propelled from the oral cavity to the pharynx in the oral propulsive stage. The tip and sides of the tongue contact the palate and serve as anchors to move the bolus from the anterior to posterior using a squeezing mechanism. The pharyngeal stage usually occurs immediately after the bolus reaches the pharynx and the swallowing reflex is initiated. The swallowing reflex is a complicated movement involving many nerves and muscles in the oral cavity, tongue, pharynx, and larynx. The hyoid bone moves anteriorly and superiorly, the larynx closes, the upper esophageal sphincter opens, and the bolus moves from the pharynx into the esophagus. The esophageal stage starts once the bolus comes into the esophagus. Esophageal peristalsis is activated and the bolus finally reaches the stomach. This four-stage sequence model explains drinking well.

Recently, swallow with chewing was evaluated and it was found that chew-swallow could not be explained by the four-stage sequence model. Therefore, the process model has advocated chew-swallow (eating) [4, 5]. In the process model, the bolus moves from the tongue surface to the postcanine region by the pulling-back movement of the tongue (stage I transport). Then, the bolus is continuously chewed in the oral cavity and softened by moistening until the food bolus reaches optimal cohesiveness and is ready for swallowing (processing). Simultaneously, the bolus is actively driven by the tongue squeezing and transported to the middle pharynx (stage II transport). The characteristic

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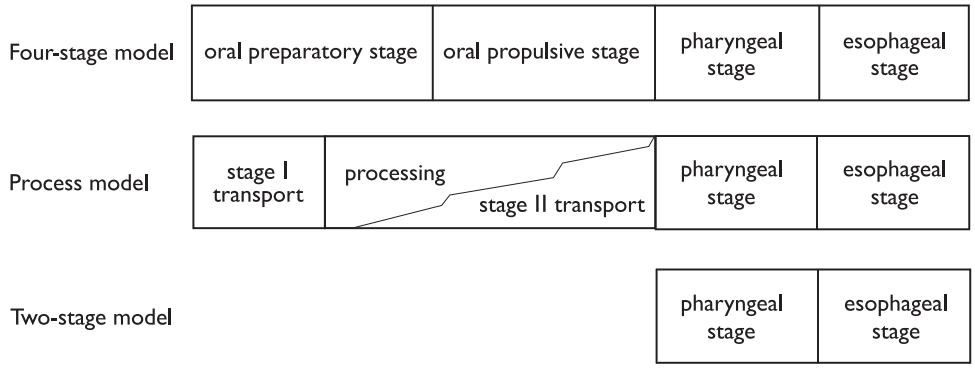

Figure 1. Physiological models of swallowing.

of the process model is that food processing and stage II transport overlap substantially in time. The pharyngeal stage, which occurs from the initiation of swallowing reflex, and the esophageal stage, which starts after the bolus comes into the esophagus, are similar between the four-stage sequence model and the process model; the key difference is the timing of initiation of the pharyngeal stage. The swallowing reflex starts subsequently after the bolus reaches the pharynx in the four-stage sequence model (drinking), but does not occur immediately after the bolus is transported to the middle pharynx in the process model (eating). Moreover, an isolated pharyngeal swallow (IPS) which consisted of pharyngeal and esophageal stages (two stages) without prior intraoral transport by the tongue was found in both drinking and eating [6]. IPS is considered to be a protective swallow to prevent aspiration when the bolus reaches the pharynx unexpectedly. We distinguish drinking and eating unconsciously, but the physiological phenomenon is not the same.

Application to dysphagia rehabilitation

The differences in this physiological phenomenon greatly affect dysphagia rehabilitation. In general, aspiration becomes less likely to occur with thickener, while a larger amount of bolus leads to aspiration. How about the presence or absence of mastication? The level of difficulty for aspiration in each bolus used in videofluoroscopic examination of swallowing (VF) was reported [7, 8] (Table 1). Liquid and solid food are likely to be mixed in the oral cavity or we often eat mixed food like miso soup during an ordinary meal. A two-phase mixture (4 g of corned beef hash and 5 mL of thin liquid) mimics this state. The lowest risk of aspiration is with 4 mL of thick liquid, while 30 g of liquid from a cup is the most likely to be aspirated. In Table 1, corned beef hash and a two-phase mixture account for chew-swallow and mixed food is likely to be aspirated. Therefore, aspiration may be overlooked if we check only liquid drinking. The bolus comes into the pharynx before the swallowing reflex in chew-swallow by stage II transport, and in particular, the liquid part of the bolus reaches even the hypopharynx before the swallow onset with a mixture, resulting in

Table 1. Level of difficulty for aspiration with each bolus.

○ less likely to aspirate ● likely to aspirate

	4 mL of thick liquid	8 g of corned beef hash	4 mL of thin liquid	10 mL of thin liquid	One cup swallow	Two-phase mixture	30 g of liquid from a cup
4 mL of thick liquid		○	○	○	○	○	○
8 g of corned beef hash	●		○	○	○	○	○
4 mL of thin liquid	●	●		○	○	○	○
10 mL of thin liquid	●	●	●		○	○	○
One cup swallow	●	●	●	●		○	○
Two-phase mixture	●	●	●	●	●		○
30 g of liquid from a cup	●	●	●	●	●	●	

Two-phase mixture = 4 g of corned beef hash and 5 mL of thin liquid.

an increased risk of aspiration [9]. A bolus that does not require mastication is safer for patients with a high risk of aspiration.

The stage transition duration (STD) is defined as from the moment at which the bolus passes the lower border of the ramus of the mandible to the time at which the maximal excursion of the hyoid is initiated [10]. An STD of more than 1.0 s is assessed as delayed swallowing reflex and prolonged STD values are associated with an increased risk of aspiration. However, it was recently found that delayed STD was within normal limits in chew-swallow and did not cause aspiration. Moreover, STD differs even in normal individuals between with and without mastication [11, 12]. We have to interpret STD carefully in chew-swallow.

Conclusions

The concept of chew-swallow has brought about a paradigm shift in dysphagia rehabilitation. Dentures in old people and personal habit affect the presence or absence, and number of times, of mastication. When selecting meals for patients with dysphagia, we must check the state of mastication. We need to recognize that drinking and eating are different in dysphagia rehabilitation.

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