Challenges of Overcoming of Swallowing Difficulty Following Total Glossectomy, Laryngectomy and Resection of the Mandible

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舌全摘出術, 喉頭摘出術, 下顎骨区域切除術後症例の摂食嚥下障害

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液体と半固形物の摂取が可能であった舌全摘出術, 喉頭摘出術, 下顎骨区域切除術, 大胸筋皮弁による再建術症例の嚥下動態について報告した。術後1ヶ月と, 経口摂取が可能となっていた術後9ヶ月に嚥下透視ビデオ検査を行った。上・中, 下咽頭後壁の咽下動態を, 嚥下透視ビデオ検査で得られた画像を元に1フレーム毎評価した。術後1ヶ月に比べ, 術後9ヶ月では, 上中下咽頭の一連の大きな蠕動様運動が観察できた。また, 顎を引き上げて咽頭腔を確保して咽下していた。咽下の際, 食塊を咽頭腔に保持し, 蠕動様運動により咽頭後壁が舌再建筋皮弁に接触することが, 特に半固形物を摂取する上で重要であった。嚥下を開始するにあたって, 味覚, 嗅覚を促す指導を行なった。舌全摘出, 喉頭摘出を行なう症例であっても, 広範囲な器質的変化に適応するためには, 術後早期からの摂食嚥下指導訓練が必要である。

Key words: glossectomy, laryngectomy, posterior pharyngeal wall, reconstruction, dysphagia

Introduction

The severity of swallowing difficulties after head and neck surgery depends on the range of excision as well as the patient's age, concurrent chemoradiotherapy and other diseases. Swallowing difficulties resulting from structural changes in the oropharyngolaryngeal area require rehabilitation. In the normal swallowing process, bolus propulsion in the oral phase is facilitated primarily by the actions of the tongue, and contact with the posterior pharyngeal wall by the tongue base plays an important part in the pharyngeal stage of swallowing. During swallowing, the base of the tongue and pharyngeal walls make complete contact in order to propel the bolus though the pharynx. The movement of the posterior pharyngeal wall, including peristalsis-like waves, has been measured and investigated. In this report, we aim to discuss the conditions of oral feeding in cases of total glossectomy, laryngectomy and subtotal mandibulectomy, emphasizing the importance of making complete contact by the reconstructed tongue base with the pharyngeal wall. The degree of contact affects the food consistency of the patient’s oral intake and quality of life. We also emphasize the need for swallowing rehabilitation in patients without a risk of aspiration.

Case report

Present illness

A 57-year-old male visited our department of Otolaryngology-Head and Neck Surgery with chief complaints of increasing swelling of the chin and pain in the region of the floor of the mouth. He had noticed swelling of the chin 20 months prior to presentation. During a period of six months before the current referral, the patient's body weight had dropped from 60 kg (BMI: 22.7) to 51 kg (BMI: 19.3).

On a physical examination, a tumor was found to be located in the floor of the mouth, invading the mucosa of the lower lip, alveolar bone, genioglossal muscle, geniohyoid muscle, mylohyoid muscle and lower jaw skin. MRI and PET images indicated the presence of a primary tumor with lymph node metastasis to the right submandibular region (Fig. 1). The patient was subsequently diagnosed as having carcinoma of the oral cavity mouth floor, T4aN2bM0; the histopathological diagnosis was squamous cell carcinoma.

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Treatment and clinical course

The treatment and status of nutrition of the patient are summarized in Figure 2. Chemotherapy consisting of fluorouracil (5-FU) at a dose of 1,125 mg/body for five days and nedaplatin (Aqupla) at a dose of 120 mg/body for one day was administered. Surgery was performed 35 days after the completion of chemotherapy. The surgical intervention included modified radical neck dissection of the right side of the neck as well as selective neck dissection of the left side and total removal of the tongue, floor of the mouth and larynx. The superior and middle pharyngeal constrictor muscles were preserved; however, the anterior part of the inferior pharyngeal constrictor muscles was incised as a result of removal of the larynx. The mandible and lower jaw skin were also removed, with the exception of the condylar process on both sides. A titanium plate was substituted for the extensively excised mandible in order to affix the condylar process on both sides, while a greater pectoral muscle flap was used to cover the titanium plate and oral cavity and the floor of the mouth was reconstructed with a contralateral greater pectoral muscle flap. Additional postoperative radiotherapy was given to the patient, with a total dose of 60 Gy, including both sides of the oropharynx and hypopharynx.

During the period of radiotherapy, the patient reported that he had experienced visual and auditory hallucinations for more than 10 years, without medical treatment. He was therefore diagnosed with schizophrenia and started on psychiatric medications.

1. Swallowing difficulty and rehabilitation during the period of hospitalization

Oral feeding was initiated three weeks after the surgery in addition to continued nasogastric feeding. The patient was able to lift his mandible approximately 1 cm; however, he had difficulty in closing his lips. As a result, a syringe was used to aid the intake of liquids, and nasogastric feeding was continued because it took the patient 25 minutes to drink 200 ml of fluid. Swallowing intervention with a speech therapist was planned.

At the first interview, the patient did not perceive taste; therefore, he was advised to drink liquids with a strong taste after smelling them so as to help him to more easily recognize the fluids and support the improvement in his sense of taste. At the same time, the proper method for effectively using his olfactory organs was introduced. A tube of approximately 30 cm in length was prepared, and the patient was asked to place one edge of the tube into his mouth and attach the other side to the tracheostoma. The patient then inhaled and identified the aroma and odor through the tube. He was instructed to consume liquids by pooling the liquids in the hypopharynx and waiting...
until the swallowing reflex occurred. He was also started on exercises to stretch and strengthen the muscles around the neck.

Five weeks after the surgery and two weeks after the swallowing intervention, the patient achieved independence of oral intake and was able to drink 700 ml of thick liquid over 20 minutes. He also appeared to perceive taste to a degree. For example, he was able to distinguish orange juice from grape juice without looking at the glass, and preferred to eat the soup of beef stew or green vegetables. We did not perform taste testing. The patient was able to consume a full level of nutrition with only oral intake during radiotherapy.

2 Swallowing difficulty and rehabilitation after discharge from the hospital

The patient was discharged to home 12 weeks after the surgery. He was encouraged to eat semisolid foods, such as pudding or yogurt, using a teaspoon with a long grip. However, he was subsequently referred to a mental hospital with a diagnosis of deterioration of schizophrenia 18 days after discharge and, after hospitalization, refused to eat or drink. Therefore, percutaneous tube feeding was initiated following endoscopic gastrostomy. More than five years postoperatively, he is currently free from tumor recurrence and sometimes consumes small amounts of semisolid foods or liquids with a syringe or spoon orally.

Videofluorographic findings

Evaluations of 3-ml barium swallowing on videofluorography were performed one month after the surgery and at nine months, when the side effects of radiotherapy disappeared (Fig. 3-1, 2). On the first evaluation (Fig. 3-1), the barium pooled in the pharynx, and the patient lowered his chin down with a slight nod while swallowing. Much of the barium was regurgitated into the oral cavity (frame no. 6-8 in Fig. 3-1), while a small amount passed through the hypopharynx. On the second evaluation (Fig. 3-2), the barium pooled in the hypopharyngeal space, and the patient lifted his mandible so that the hypopharyngeal space became wider than the resting position (frame no. 2 in Fig. 3-2). The nasopharyngeal space closed (frame no. 3 in Fig. 3-2), and a thick wave-like pharyngeal wall movement occurred while swallowing (frame no. 3-15 in Fig. 3-2). The anterior bulge of the pharyngeal wall became three to four times larger than that observed in the

![Fig. 3-1. Videofluorographic images.](image)

Liquid swallowing one month after the operation. Arrows show the regurgitation of the bolus (frame no.6-8).
Fig. 3-2. Videofluorographic images. Nine months after the operation.

Fig. 4. The posterior pharyngeal wall (PPW) movement and the transit time of the bolus. A, B and C are the points of measurement of the PPW. A: level of the antero-upper margins of C2, B: the antero-upper margins of C3, and C: the antero-lower margin of C4, one month (left side) and nine months (right) after the operation. The ratios of the anterior bulge of the PPW during swallowing against the thickness of the PPW at rest and the transit time of the bolus were compared between one month and nine months after operation.
resting position. When the wave of the posterior pharyngeal wall movement reached the bolus (frame no. 11 in Fig. 3-2), the head of the bolus pooled at the level of the fifth cervical vertebra and began to descend into the esophagus (frame no. 11-15 in Fig. 3-2). Complete contact of the base of the reconstructed tongue with the pharyngeal wall was also observed (frame no. 8-15 in Fig. 3-2), and none of the barium remained in the hypopharynx. Similar findings were observed following the consumption of pudding.

The size of the anterior bulge of the posterior pharyngeal wall noted during swallowing was measured frame by frame. The points of measurement included the level of the anterior upper edge of the second and third cervical vertebrae and the anterior lower edge of the fourth vertebra. The ratio of the anterior bulge of the PPW during swallowing to the thickness of the PPW at rest was compared at one and nine months after the operation. At the same time, the transit time of the bolus, i.e., the interval from the head of the bolus to the tail of the bolus passing through at the level of the lower margin of the fifth vertebra, was also calculated (Fig. 4). One month after the procedure, the bolus began passing through the pharynx immediately after the start of the posterior pharyngeal wall movement at the level of the anterior upper edge of the second cervical vertebra. The transit time of the bolus was 0.33 seconds. Nine months later, increased movement of the posterior pharyngeal wall directing downward in a peristalsis-like movement was observed, and the bolus passed through the pharynx in association with the pharyngeal wall movement. The transit time of the bolus was 0.57 seconds.

**Discussion**

The swallowing function after total glossectomy with or without laryngectomy has been previously investigated. For example, Tiwari reported that only one out of 21 patients ate a normal diet, while the remaining 20 patients required ground up food. On cineradiography, posterior pharyngeal wall movement was observed to be involved in pushing the bolus. In addition, Tiwari and Massengill speculated that the compensatory mechanism underlying the increased downward movement of the soft palate with a consequent reduction in the intraoral space in addition to abnormal bulging of the posterior pharyngeal wall at approximately the level of the third cervical vertebra appears to contribute to a normal swallowing function.

The effects of surgery on the swallowing function in head and neck cancer patients depends on the extent of resection. In the present case, the patient exhibited almost the complete loss of motion in the preparatory and oral stages after surgery. Therefore, foods of thin viscosity, such as semisolid foods and liquids, should be selected for oral intake in such patients.

Tanahashi demonstrated that the base of the tongue and pharyngeal wall reciprocally cooperate following dysphagia due to structural changes caused by surgery and that this movement plays a compensatory role accounting for the movement lost after resection. In the current case, the pharyngeal wall movement was the only propelling force for passing the bolus through the pharyngeal space to the esophagus, and the range of anterior movement of the posterior pharyngeal wall during swallowing was increased three to four times that of the posterior pharyngeal wall at rest. Furthermore, a greater increase in the anterior bulge of the pharyngeal wall was observed, even at the level above the site of contact of the reconstructed tongue with the pharyngeal wall, at nine months versus one month after the operation. It is notable that such a range of pharyngeal wall movement occurred in order to compensate for the loss of posterior movement of the tongue base.

The enlargement in the pharyngeal space observed during videofluorography when the patient lifted his mandible may have allowed him to hold more amount of bolus and enable the posterior pharyngeal wall to move forward. These findings suggest that the pharyngeal space should be maintained so as not to disturb pharyngeal contractions in order to prevent the bolus in the hypopharynx from regurgitating into the oral or nasal cavity. However, if the pharyngeal space is too wide and the tongue base does not make contact with the anterior bulge of the posterior pharyngeal wall, food of thicker consistency will not pass through the pharynx due to the loss of an adequate pressure required for pharyngeal swallowing. The volume of the reconstructed tongue is thus quite important for improving oral intake. Therefore, in the current case, prolongation of the transit time of the bolus was observed nine months after surgery due to the existence of a wider pharyngeal space, which allowed a greater amount of bolus to pool, and also made it possible to achieve adequate pharyngeal contractions, which were sufficient to propel the entire bolus to the esophagus.

The swallowing difficulty observed in our patient soon after surgery was the result of maladjustment due to the drastic change in the oropharyngolaryngeal structure. Swallowing rehabilitation must be initiated as soon as possible in such cases. With respect to swallowing intervention, taste is an essential motivating factor for increasing oral intake. In the present case, the patient’s sense of taste
was preserved to some degree, which enabled him to continue to consume foods and drinks of different tastes. The taste sensation appears to be activated in the lower palatoglossal and palatopharyngeal arches. However, the patient’s psychogenic problems caused him to lose the motivation to consume foods orally despite our encouragement. The loss of smell causes various difficulties in activities of daily living and impairments in the quality of life\(^{(1)}\). We believe that the use of a tube to allow the patient to fully inhale through the nose was helpful for allowing him to confirm the sense of smell and taste, thereby motivating him to eat under conditions of a weak swallowing function.

**Conclusion**

We herein reported a case of swallowing difficulty after total glossectomy, laryngectomy and wide resection of the mandible in which the patient was able to consume liquids and some semisolid foods. During swallowing intervention, the degree of contact of the reconstructed tongue with the posterior pharyngeal wall is an essential element for propelling the bolus through the pharynx to the esophagus. Swallowing rehabilitation should therefore be introduced immediately after surgery in order to maintain the patient’s interest in oral feeding.

**References**