

Obturator Prosthesis for Velopharyngeal Insufficiency after Treatment of Soft Palate Cancer - A Case Report -

Deog Young Kim, M.D., Chang-il Park, M.D., So Young Joo, M.D., Su Jin Yu, M.D.

Department and Research Institute of Rehabilitation Medicine, Yonsei University College of Medicine, Seoul 120-752, Korea

Velopharyngeal insufficiency after surgical resection of soft palate cancer can be troublesome. This report concerns a male suffered from severe dysphagia following combined treatment for soft palate cancer. Sequential videofluoroscopic swallowing studies (VFSS) were used to assess his swallowing function and plan the interventional strategies. Initial VFSS showed huge nasal regurgitation, increased oral transit time, residues in oral cavity, delayed swallowing reflex, pharyngeal residue, impaired laryngeal elevation, and aspiration in semisolid and liquid trials. Obturator prosthesis was fabricated to minimize velopharyngeal insufficiency. After application of obturator prosthesis, swallowing dysfunction in oral and pharyngeal stages was markedly improved. Nasal regurgitation was not shown. Oral residue, oral transit time in oral stage also improved. Residue on vallaculæ and pyriform sinuses decreased in pharyngeal stage. Aspiration also decreased. We reported successful obturator prosthesis application with sequential changes of clinical and VFSS findings in our case.

Key Words Soft palate cancer, Obturator, Dysphagia

INTRODUCTION

Head and neck cancer is one of the ten most common cancers, for which treatments vary depending upon the clinical characteristics of the patient, the location of the tumor, the clinical stage and the possibility of surgical removal of the tumor. But principally, surgical operations, radiotherapy and chemotherapy are adhibited in combination with each other. In patients with head and neck cancer, dysphagia is a very common complication. It occurs due to the cancer in itself, but its occurrence is more common after treatment. This is because anatomical defects or sensory impairment or motor hypofunction may arise in the process of treatment. In addition to them, aspiration increases

in that process.¹ Also, it may cause various complications including aspiration pneumonia and hinders nutritional ingestion and thus delays the recovery of general condition. As a result, it extends the period of hospitalization and lowers the quality of life.^{1,2}

In head and neck cancer, soft palate cancer is mostly squamous cell cancer. In many cases, it involves the extensive excision of organs such as the base of tongue, the soft palate and the tonsil. Such excision brings about severe dysphagia.² Moreover, the excision of the soft palate causes velopharyngeal insufficiency, from which hypernasality, dysphagia and nasal regurgitation occur.¹ As regards velopharyngeal insufficiency, swallowing rehabilitation therapy including reconstructive surgeries or obturator prostheses are used to restore

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Corresponding author: Su Jin Yu

Department and Research Institute of Rehabilitation Medicine, Yonsei University College of Medicine, 250 Seongsan-ro, Seodaemun-gu, Seoul 120-752, Korea

Tel: +82-2-2228-3730, Fax: +82-2-363-2795, E-mail: bluedimple@yuhs.ac

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swallowing function. However, video fluoroscopic swallowing study (VFSS)-based objective assessment have not been made of changes in oral and pharyngeal phases.

This paper is to report a case where a patient suffered from dysphagia in consequence of extensive surgical resection and adjuvant chemoradiotherapy for soft



Fig. 1. Surgically acquired maxillary defect including entire soft palate, partial hard palate, left tonsil, base of tongue, pharyngeal wall.

palate cancer. VFSS was performed to evaluate and assessment the progress of dysphagia, wherewith the obturator prosthesis and swallowing rehabilitation were applied to the patient. This whole process is as in the following.

CASE REPORT

A 71-year-old male was diagnosed with stage-IV soft palate cancer and underwent an extensive resection on the soft palate, the hard palate, the tonsil, the base of tongue and the pharyngeal wall and a reconstructive surgery on the forearm free flap (Fig. 1). Since the operation wound opened up 3 weeks after the operation, a revision surgery was performed. Three months after the operation, the patient began to undergo concomitant chemoradiotherapy including radiotherapy 562 Gy at a time, 30 times in all and chemotherapy Cetuximab 405 mg at a time, 6 times in all. Afterwards, upper gastrointestinal bleeding occurred, whereupon conservative treatment was performed in the intensive care unit. Six months after the operation, the patient was transferred to the general ward. Three months later the

Table 1. Changes of ASHA NORMS and Videofluoroscopic Swallowing Study Findings

ASHA NORMS	Pre	Just before	Just after	2 wks later	1 mos later	4 mos later
	1	1	2	3	4	5
PAS						
12% semisolid (5 cc)	8	8	2	1	1	1
12% semisolid (15 cc)	8	8	1	1	1	1
6% semisolid (5 cc)	8	8	1	1	1	1
6% semisolid (15 cc)	8	2	1	1	1	1
Liquid (5 cc)	8	8	7	4	2	2
Liquid (15 cc)	8	8	8	7	7	7
FDS						
Lip closure	0	0	0	0	0	0
Bolus formation	3	3	0	0	0	0
Residue in oral cavity	2	2	0	0	0	0
Oral transit time	6	6	0	0	0	0
Triggering of pharyngeal swallow	10	10	10	10	10	10
Laryngeal elevation and epiglottic closure	12	12	12	12	12	12
Nasal penetration	12	12	0	0	0	0
Residue in valleculae	8	8	4	4	4	4
Residue in pyriformis sinuses	8	8	4	0	0	0
Coating of pharyngeal wall after swallow	10	10	0	0	0	0
Pharyngeal transit time	4	4	4	4	4	4
Total	75	75	34	30	30	30

PAS: penetration-aspiration scale, FDS: functional dysphagia scale, ASAH NOMS: American-speech-language-hearing association national outcome measurement system

patient was transferred to the rehabilitation hospital so as to undergo aggressive swallowing rehabilitation when he could orally ingest nothing due to continuous dysphagia and aspiration and thus was fed through nasogastric tube (NGT) and intravenous nutrition. The American-Speech-Language-Hearing Association National Outcome Measurement System (ASHA NORMS) score was 1. The weight fell off from 67 kg to 50 kg during hospitalization, and the body mass index (BMI) was 17.7. The prealbumin level and the albumin level were 157 mg/L and 3.1 g/dl respectively. Taken altogether, the patient was in underweight and undernourishment. VFSS was performed immediately after the patient was transferred to the rehabilitation ward, whereon tongue hypomotility was observed. Actually, the patient had problems making a bolus and carrying it to the pharynx, wherefore the oral transit time was delayed, and intraoral leftovers were about 10%. In pharyngeal phase, most of boluses were regurgitated into the nasal cavity, and the delay of swallowing reflex and pharyngeal

peristalsis was observed in addition to the reduction of laryngeal elevation. Approximately one third of a bolus was left over in the vallecula, the pyriform sinus and the pharyngeal wall despite continuous swallowing. Such being the case, the pharyngeal transit time tended to be delayed. The functional dysphagia scale (FDS) score was 75, which fell under dysphagia. In addition, all types of diets including semisolid and liquid diets were aspirated into the airway without any coughing, and the penetration-aspiration scale (PAS) score was 8 (Table 1).

For the above reasons, the patient was prohibited from orally ingesting food, and rehabilitation treatment was performed including oromotor facilitating and tongue and neck muscles strengthening. Additionally, the soft palate obturator prosthesis was fabricated to make up velopharyngeal insufficiency, caused by a velopharyngeal defect, in cooperation with a prosthetist (Fig. 2). The soft palate obturator prosthesis was designed so that it could obturate the defective regions of the soft palate and the hard palate, and extended backward to the pharynx so that the oropharyngeal cavity could be separated from the nasopharyngeal cavity. The second VFSS was again performed right before the application of the obturator prosthesis. Notwithstanding rehabilitation treatment, significant improvements were not observed. Penetration was observed in 6% semi-solid diets, but in other diets, aspiration was observed. Immediately after prosthetic application, the problem of nasal regurgitation was completely solved. The bolus was normally formed and was carried to the pharynx more rapidly, and the oral transit time was within the normal range (Fig. 3). In pharyngeal phase, the residue in the vallecula and the pyriform sinus, was remarkably reduced. The residue in the pharyngeal wall were not observed, and the FDS score was improved to 34. The



Fig. 2. Obturator prosthesis for soft palate defect.

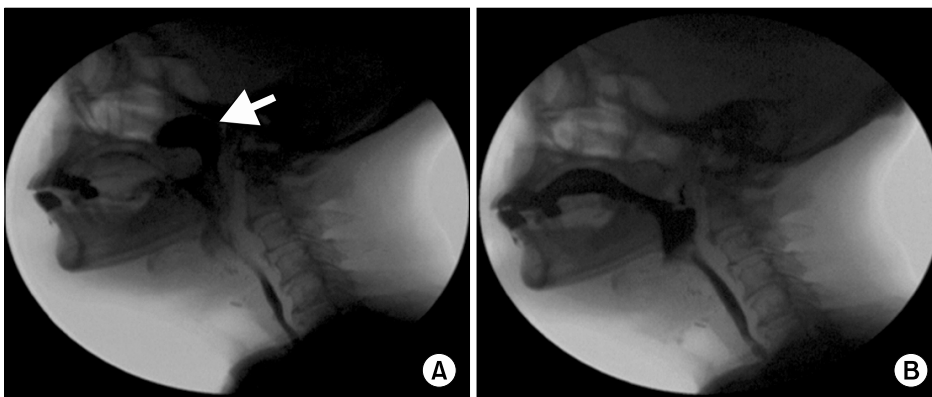


Fig. 3. Changes of VFSS findings after obturator prosthesis. (A) Without obturator prosthesis: VFSS showed large amount nasal regurgitation of semisolid with contrast media. (B) With obturator prosthesis: VFSS showed no nasal regurgitation and adequate velopharyngeal port closure.

manifestation of aspiration was observed in liquid diets, but was not observed in semisolid diets. But in the delay of swallowing reflex, laryngeal elevation and pharyngeal transit time, significant changes were not observed. On the authority of such results, the viscosity of diets was gradually heightened after prosthetic application. The diet was controlled from the dysphagia diet I with the exclusion of liquid to the stage II. Since the obturator prosthesis separates the nasopharynx from the oropharynx and thus makes naso-gastric insertion impossible, the patient was trained for the oesophageal tube so that he could take nourishment and water sufficiently. In addition, the patient was given temperature and tactile stimuli and underwent exercise to strengthen and control tongue and neck muscles. Additionally, the patient was trained for compensatory techniques such as chin tuck, effortful swallow and double swallow. Nevertheless, the patient complained of shortness of breath and foreign body sensation whenever taking a meal with the prosthesis on, whereupon he was trained for the supraglottic swallow, *i.e.*, taking a deep breath before swallowing a bolus of food, holding the breath while swallowing it, and coughing after swallowing. And the prosthesis was remodeled in order that the foreign body sensation reduce minimally also defect could be made up maximally, and as a result the symptoms were remarkably reduced.

Also, the patient complained of dysarthria caused by hypernasality, which was improved after prosthetic application. Actually, consonant correct was improved from 58% to 84% and thus speech intelligibility was improved generally.

VFSS was conducted again 2 weeks after prosthetic application, whereon the residue in the pyriform sinus was not observed, unlike the result shown immediately before prosthetic application. However, other significant differences were not observed. The FDS score was slightly lowered from 34 to 30. In relation to the small quantity of liquid diets, aspiration was changed to penetration. But in the large quantity, the manifestation of aspiration was observed. Nonetheless, significant changes were not observed in relation to the delay of swallowing reflex, the delay of pharyngeal peristalsis, the delay of pharyngeal transit time and the residue in the vallecula. The patient continuously underwent swallowing rehabilitation, and the food thickener was added to liquid diets. The patient had been able to orally take soft food one month after wearing the obturator

prosthesis, and partially took liquid diets to which the food thickener was added. And supplementary water was supplied through the oesophageal tube. In those conditions, the patient got out of the hospital, when his weight, BMI and albumin level were 53 kg, 18.3 and 3.5 g/dl respectively. In general, such values were improved compared to ones measured when the patient was in the rehabilitation ward. VFSS was conducted right before the patient's getting out of the hospital, (1 month after prosthetic application) and during the follow-up (4 months after prosthetic application), but there was no significant difference between two. Four months after wearing the obturator prosthesis, the patient had been able to take nourishment and drink water without the oesophageal tube.

DISCUSSION

After surgical treatment of head and neck cancer, dysphagia may occur in oral and pharyngeal phases. Generally, the wider the resection gets, the severer dysphagia becomes.³ But in practice, postoperative swallowing function is known to be more affected according to how much organs necessary for making a bolus, carrying it to the pharynx and protecting the airway (*e.g.*, the tongue, the base of tongue, the arytenoid cartilage and the soft palate) are excised. In patients with oropharyngeal cancer who underwent resection, the aspiration rate is reported to be between 12 and 50%.^{4,5} The excision of the soft palate causes velopharyngeal insufficiency.² Also in this case, VFSS showed that many boluses were regurgitated into the nasal cavity. It is deemed that the soft palate functioned as a functional separator between the oral cavity and the nasal cavity, *i.e.*, a muscular valve. After the application of the obturator prosthesis, bolus formation, intraoral residue and oral transit time were normalized, which coincided with the report of Davis et al.⁶ According to their report, the obturator prosthesis obturated the palatal defect and made the tongue and the prosthesis meet, which heightened intraoral pressure and then reduced intraoral residues. In this case, improvements were observed in relation to swallowing in oral phase and to nasal regurgitation caused by velopharyngeal insufficiency, and in relation to residue in and the pyriform sinus and the pharyngeal wall, a reduction was observed after the application of the obturator prosthesis, which implies that the obturator prosthesis first prevents na-

sal regurgitation and heightens intraoral and intrapharyngeal pressure and thus is helpful to swallowing in oral and pharyngeal organs. But in this case, significant changes were not observed in relation to the delay of swallowing reflex in pharyngeal phase, laryngeal elevation and pharyngeal transit time, which is assumed to be related to what the patient underwent not only surgical resection but also chemoradiotherapy. Eisbruch et al.⁷ evaluated patients with head and neck cancer who underwent combined radiotherapy and chemotherapy by using VFSS, and reported that the reduction of laryngeal elevation was increased from 18% to 77%; the delay of deglutition reflex from 36% to 62%; aspiration from 14% to 62%, which coincides with this case. In particular, dysphagia, caused by the fibrosis of the tongue, the base of tongue, the pharynx and the larynx, has been reported in at least 50%. It shows that in the case of dysphagia in patients with head and neck cancer, the anatomic defect should be compensated through the reconstructive surgery or the obturator prosthesis as well as rehabilitation therapy should be performed for sequelae from radiotherapy and chemotherapy.^{1,8}

Velopharyngeal insufficiency causes not only dysphagia but excessive nasality and thus lowers speech intelligibility. In this case, consonant intelligibility was improved after the application of the obturator prosthesis, which coincided with previous studies.^{5,9}

To velopharyngeal insufficiency, the reconstructive surgery or the obturator prosthesis can be applied. All of the two have been reported to improve dysphagia. A recent study reported that the two were not much different from each other in the efficacy for dysarthria, but there have been few studies on for what they and which one would be effective.^{5,9} With the development of various reconstructive surgeries, palatal defects have been successfully compensated, and as a result the need for obturator prostheses has been reduced; even so, the reconstructive surgery may leave an inappropriate separation between the oral cavity and the nasal cavity in the process of articulation and swallowing, and besides, the non-epithelized operation wound may induce contracture and these contracture may widen in the process of wound healing or postoperative radiotherapy.¹⁰ An impossible or failed reconstructive surgery can be substituted by an obturator prosthesis. The obturator prosthesis can be taken and remodeled when necessary, but has problems with substituting the soft palate due to its hardness, and moreover, it con-

stipates surrounding muscles. Additionally, it is cumbersome to wear the prosthesis from patients' viewpoint.^{9,10} Also in this case, the patient complained of uncomfatableness in early days and of dyspnea when taking food orally. He was trained to take a deep breath before swallowing food and swallow it holding his breath. Afterwards such symptoms were relived. These problems should be reflected in the application of obturator prostheses.

In relation to dysphagia caused by treatments for head and neck cancer, various studies have been carried out throughout the world, but in rehabilitation medicine, great concern has not been caused. Hereat, physiatrists, who are richly experienced in treating dysphagia, are expected to make valuable contributions. Furthermore, there is a need to approach therapeutic studies in cooperation with various sections.

REFERENCES

- 1) Pauloski BR. Rehabilitation of dysphagia following head and neck cancer. *Phys Med Rehabil Clin N Am* 2008; 19: 889-928
- 2) Logemann JA, Pauloski BR, Rademaker AW, McConnel FM, Heiser MA, Cardinale S, Shedd D, Stein D, Beery Q, Johnson J, et al. Speech and swallow function after tonsil/base of tongue resection with primary closure. *J Speech Hear Res* 1993; 36: 918-926
- 3) Nicoletti G, Soutar DS, Jackson MS, Wrench AA, Robertson G. Chewing and swallowing after surgical treatment for oral cancer: functional evaluation in 196 selected cases. *Plast Reconstr Surg* 2004; 114: 329-338
- 4) Pauloski BR, Rademaker AW, Logemann JA, McConnel FM, Heiser MA, Cardinale S, Lazarus CL, Pelzer H, Stein D, Beery Q. Surgical variables affecting swallowing in patients treated for oral/oropharyngeal cancer. *Head Neck* 2004; 26: 625-636
- 5) Kreeft AM, van der Molen L, Hilgers FJ, Balm AJ. Speech and swallowing after surgical treatment of advanced oral and oropharyngeal carcinoma: a systematic review of the literature. *Eur Arch Otorhinolaryngol* 2009; 266: 1687-1698
- 6) Davis JW, Lazarus C, Logemann J, Hurst PS. Effect of a maxillary glossectomy prosthesis on articulation and swallowing. *J Prosthet Dent* 1987; 57: 715-719
- 7) Eisbruch A, Lyden T, Bradford CR, Dawson LA, Haxer MJ, Miller AE, Teknos TN, Chepeha DB, Hogikyan ND, Terrell JE, et al. Objective assessment of swallowing dysfunction and aspiration after radiation concurrent with chemotherapy for head-and-neck cancer. *Int J Radiat Oncol Biol Phys* 2002; 53: 23-28
- 8) Nguyen NP, Moltz CC, Frank C, Vos P, Smith HJ, Karlsson U, Dutta S, Midyett FA, Barloon J, Sallah S. Dysphagia

- following chemoradiation for locally advanced head and neck cancer. *Ann Oncol* 2004; 15: 383-388
- 9) Rieger J, Bohle Iii G, Huryh J, Tang JL, Harris J, Seikaly H. Surgical reconstruction versus prosthetic obturation of extensive soft palate defects: a comparison of speech outcomes. *Int J Prosthodont* 2009; 22: 566-572
- 10) Gillespie MB, Eisele DW. The uvulopalatal flap for reconstruction of the soft palate. *Laryngoscope* 2000; 110: 612-615