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**Original Article**

## **Risk Factors for Postoperative Dysphagia in Oral Cancer**

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### **Abstract**

With the founding of its Oral Cancer Center at the Ichikawa General Hospital, Tokyo Dental College established a support system for patients and family members that not only provides surgery and other conventional cancer-oriented treatments, but also palliative care, nutritional support, rehabilitation, and discharge support. With this in mind, the present study sought to examine the nature of support for oral cancer patients with postoperative eating and swallowing disorders by investigating these disorders and identifying their risk factors. The study population comprised 75 surviving oral cancer patients (46 men and 29 women) discharged from the Tokyo Dental College Oral Cancer Center following treatment over a 2-year period from April 2009 to March 2011. Risk factors affecting eating and swallowing function were identified by statistical analysis. Mean age of the patients was  $67.3 \pm 13.7$  years. Fifteen patients had stage I cancer, while 25 had stage II, 13 had stage III, and 22 had stage IV. The feeding route at the time of discharge was oral feeding in 74 patients and a combination of oral and gastrostomy tube feeding in 1 patient. The Tokyo Dental College Ichikawa General Hospital has standardized the expert evaluation and rehabilitation of oral cancer patients with eating and swallowing disorders by establishing a multidisciplinary support system from the preoperative stage onwards. In this context, the results of our analysis of factors

influencing the ability of oral cancer patients to orally ingest food after treatment suggest that preoperative cancer stage classification, neck dissection, and tracheotomy are all influential factors. Patients affected by these factors require further multidisciplinary treatment, which in turn necessitates more extensive coordination with other medical professionals and community health care providers.

**Key words:** Oral cancer—Postoperative dysphagia—Risk factor—Cancer stage classification

## Introduction

The Tokyo Dental College Ichikawa General Hospital was designated a “regional hub hospital for cancer treatment” by the Ministry of Health, Labour and Welfare in February 2009, and it has established a system to coordinate and support high-quality cancer therapy. These developments were preceded by the founding of the Tokyo Dental College Oral Cancer Center (OCC) in April 2007 with the aim of contributing to the development of dental medicine by enhancing oral cancer diagnosis and treatment standards and providing advanced multidisciplinary treatment in the fields of dentistry and medicine. The OCC has established an organized support system for patients and family members that not only provides conventional cancer-oriented treatment modalities such as surgery, chemotherapy, and radiation therapy, but also provides palliative care, nutritional support, rehabilitation, and discharge support. In particular, the OCC has developed a multidisciplinary care system for the rehabilitation of oral cancer patients with the eating and swallowing disorders that inevitably occur after oral cancer therapy. This system operates from the pretreatment phase and involves oral and maxillofacial surgeons, ear, nose, and throat specialists, speech language pathologists, dental hygienists, and nurses. In the present study, the nature of support for oral cancer patients with postoperative eating and swallowing disorders was studied by investigating these disorders and identifying their risk factors.

## Materials and Methods

Analysis of risk factors associated with eating and swallowing disorders following oral cancer surgery was conducted in 75 oral cancer patients (46 men and 29 women) who underwent surgery at the OCC during the 2-year period from April 2009 to March 2011. Those who underwent multiple surgeries were still regarded as single patients. The study variables of sex, age at surgery, preoperative cancer stage, radiation therapy (Y/N), anticancer drug use (Y/N), lesion site, neck dissection (Y/N), range of neck dissection, previous medical history, tracheotomy (Y/N), and duration of tracheotomy were determined based on patient medical records and nursing records. Time until start of training using food (direct training) and time until start of oral feeding as a meal (*i.e.*, number of days after surgery), as well as feeding route (*i.e.*, oral or tube) at the time of discharge, were also surveyed as indices of severity of eating and swallowing disorder symptoms. Statistical analysis of data was performed using SPSS Ver. 19 software. Statistical testing of categorical variables was conducted using the chi-square test, intergroup testing of continuous variables was done using the *t*-test, and correlation testing between continuous variables was performed using a 1-way analysis of variance. Analysis of risk factors prolonging the time to direct training and time to oral feeding was performed using binomial logistic regression.

Informed consent was obtained from the patients after providing an oral and written explanation of the details and aims of the

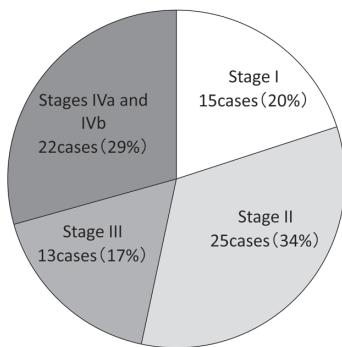


Fig. 1 Preoperative stage classification  
Preoperative cancer stages were stage I (n = 15), stage II (n = 25), stage III (n = 13), and stages IVa and IVb (n = 22)

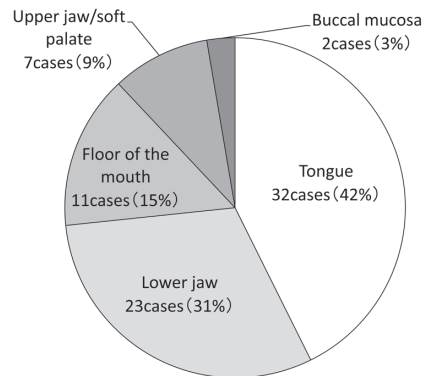


Fig. 2 Location of the tumor  
Cancers were located in buccal mucosa (n = 2), upper jaw/soft palate (n = 7), lower jaw (n = 23), tongue (n = 32), and floor of mouth (n = 11)

study and the use of personal information. Data containing personal information were anonymized to protect the identity of patients in compliance with the Act on the Protection of Personal Information and the principles of the Helsinki Declaration.

## Results

The study population (n = 75) had a mean age of  $67.3 \pm 13.7$  years and consisted of 46 men and 29 women with mean ages of  $65.7 \pm 12.4$  years and  $69.8 \pm 15.5$  years, respectively ( $p = 0.205$ ). Preoperative cancer stages were stage I (n = 15), stage II (n = 25), stage III (n = 13), and stages IVa and IVb (n = 22) (Fig. 1). Cancers were located in the tongue (n = 32), lower jaw (n = 23), floor of the mouth (n = 11), upper jaw/soft palate (n = 7) and buccal mucosa (n = 2) (Fig. 2). Feeding route at the time of discharge was oral (n = 74) and a combination of oral and gastrostomy tube (n = 1). None of the patients developed pneumonia (including aspiration pneumonia) from post-surgery to discharge. The mean and median times until starting direct training were  $15.2 \pm 13.1$  days and 11.0 days, respectively, and the mean and median times until starting oral feeding were

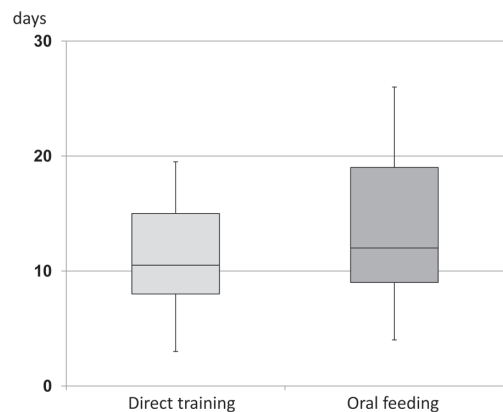


Fig. 3 Median times until starting direct training and starting oral feeding

Median time until starting direct training were  $15.2 \pm 13.1$  days and 11.0 days, respectively, and mean and median times until starting oral feeding were  $16.3 \pm 14.3$  days and 12.0 days, respectively

$16.3 \pm 14.3$  days and 12.0 days, respectively (Fig. 3). The median values were used as a guide due to the non-normal distribution of the means, and the influence of each factor was examined after assigning a value of 0 to those patients who required  $<11$  days to start direct training and a value of 1 to those who required  $\geq 11$  days.

In terms of preoperative TNM (tumor,

Table 1 Comparison of basic information on days to direct training start (Single variable quantities analysis)

		Period to direct training start		p value
		Under it for 11 days (n = 36)	More than 11 days (n = 39)	
Sex		Male 23, female 13	Male 23, female 16	0.421
Age		Av ± SD 68.7 ± 12.4	Av ± SD 66.0 ± 14.9	0.405
Preoperative stage classification	Stage I	8	7	0.007**
	Stage II	18	7	
	Stage III	5	8	
	Stage IVa + VIb	5	17	
Preoperative T classification	T1	8	8	0.010**
	T2	19	8	
	T3	5	8	
	T4	4	15	
Preoperative N classification	N0	30	24	0.106
	N1	2	4	
	N2	4	11	
Lesion of the tumor	Tongue	17	15	0.398
	Lower jaw	9	14	
	Floor of the mouth	4	7	
	Upper jaw/soft palate	4	3	
	Buccal mucosa	2	0	
Tumor excision range	Soft tissue excision	29	27	0.285
	Excision including the bone	7	12	
Range of neck dissection	Non	24	20	0.383
	Functional neck dissection	7	10	
	Classical neck dissection	5	9	
Enforcement of the tracheotomy	Non	24	20	0.302
	Minimally invasive tracheotomy	8	10	
	Commonly tracheotomy	4	9	
	Period of the tracheotomy (days)	Av ± SD .9.5 ± 6.2	Av ± SD 13.25 ± 5.2	0.099
Enforcement of the reconstruction	Non	28	19	0.027**
	Soft tissue graft	4	7	
	Soft tissue and metal plate reconstruction	4	13	
Enforcement of the radiation therapy	Non	27	31	0.425
	Enforcement	9	8	
	Radiation quantity (Gy)	Av ± SD .56.5 ± 5.7	Av ± SD .55.2 ± 5.1	0.659

Influence of each factor was determined by single variable quantities analysis.

lymph node, metastasis) classification of malignant tumors, patients in the  $\geq 11$  day group tended to have significantly higher T scores ( $p=0.010$ ), but no significant difference in N scores ( $p=0.106$ ). The preoperative cancer stage was also significantly more advanced among the majority of the  $\geq 11$  day group patients ( $p=0.007$ ). There were no significant differences in the tumor sites of the  $\geq 11$  day and  $< 11$  day groups due to the small number of patients in each tumor group. However, most patients with lower jaw

tumors, as well as most patients undergoing tumor resection involving segmental bone resection, tended to belong to the  $\geq 11$  day group. No significant differences were seen in the range of neck dissection and the presence or absence of tracheotomy. However, a significant majority of patients who underwent reconstructive surgery using a plate following tumor resection belonged to the  $\geq 11$  day group ( $p=0.046$ ). There was no significant difference between the  $\geq 11$  day group and the  $< 11$  day group in the presence

Table 2 Comparison of basic information on days to direct training start (Multivariate logistic regression analysis)

		p value	OR	95% CI	
				Upper	Lower
Sex	(Female = 0, Male = 1)	.849	.897	.295	2.733
Age		.504	.984	.939	1.032
Location of the tumor	(Buccal mucosa · Upper jaw = 0, Lower jaw = 1)	.105	6.385	.681	59.897
	(Buccal mucosa · Upper jaw = 0, Tongue · Floor of the mouth = 1)	.626	1.572	.255	9.709
Tumor excision range	(Soft tissue excision = 0, Excision including the bone = 1)	.923	1.083	.214	5.481
Graft & Reconstruction	(Non = 0, Metal plate reconstruction = 1)	.191	.137	.007	2.686
	(Non = 0, Soft tissue graft = 1)	.737	.605	.032	11.378
Tracheotomy	(Non = 0, Minimally invasive tracheotomy = 1)	.852	.800	.076	8.410
	(Non = 0, Commonly tracheotomy = 1)	.964	.950	.101	8.945
Neck dissection	(Non = 0, Functional = 1)	.932	1.097	.131	9.202
	(Non = 0, Classical = 1)	.588	2.279	.116	44.773
Preoperative stage classification	(Stage 1 · 2 = 0, Stage 3 · 4 = 1)	.031	7.395	1.202	45.503**

or absence of radiation therapy ( $p=0.425$ ). There were also no significant differences between these two groups in terms of the amount of radiation applied or the continuous number of days of tracheotomy ( $p=0.659$ ;  $p=0.099$ ) (Table 1).

On univariate analysis using a value of 0 for <11 days until starting direct training and a value of 1 for  $\geq 11$  days until starting direct training as the dependent variables, preoperative T score, preoperative N score, preoperative cancer stage, tumor resection range, tracheotomy method, and reconstructive surgery method were all identified as strongly influential factors based on a significant difference of  $<0.25$ .

Furthermore, multivariate logistic regression analysis using sex, age at surgery, preoperative cancer stage, lesion site, jaw resection (Y/N), reconstructive surgery method, tracheotomy (Y/N), tracheotomy method, neck dissection (Y/N), and range of neck dissection revealed that only preoperative cancer stage had a significant influence on eating and swallowing function ( $p=0.031$ ) (Table 2).

## Discussion

Oral cancer treatment outcomes have improved remarkably, and current therapies have moved beyond the aim of simply prolonging the patient's life to incorporate quality of life (QOL) considerations<sup>9,14,17</sup>. Because surgery is the primary treatment modality, especially for oral cancer, there has been a particular emphasis on the importance of postoperative eating and swallowing disorders and their rehabilitation<sup>6,13</sup>. Within this context, previous literature has reported on postoperative eating and swallowing disorders at numerous healthcare facilities<sup>2,3,5,7,11</sup>. However, while several studies have discussed the benefits of dentures and other prosthetic appliances in treating these disorders<sup>16,18</sup>, articles on facilities that perform systematic rehabilitation are few<sup>15</sup>. This could be attributed to the lack of medical professionals involved in treating oral cancer who also possess expertise in eating and swallowing disorders, and the scarcity of facilities with an established multidisciplinary support system for oral cancer patients with these disorders. The OCC has standardized the expert

Table 3 Contents of oral cancer postoperative feeding/dysphagia support (Oral Cancer Center, Tokyo Dental College)

	Managerial dietician	Dentist · speech-language pathologist	Dental hygienist
Preoperative	Nutrition assessment Nutrition management planning Nutritional guidance Adhibition of nutritional supplements	Assessment of the speech, feeding/swallowing function Explanation of the disorders of speech, feeding/swallowing for patient Start of the training (breathing, cough, feeding/swallowing)	Pre-operative professional oral health care
Postoperative	Nutrition evaluation Observance of nutritional intake Improvement of pattern of meals Nutrition support	Evaluation of the speech, feeding/swallowing function Screening examination of speech, feeding/swallowing function: every day Video endoscopy, videofluorography of swallowing: arbitrarily Enforcement of the training (Indirect training→Direct training) Decision of the start of the meal, pattern of meals Correspondence of the dentistry, prosthesis for the improvement of the speech, feeding/swallowing function	Post-operative professional oral health care Functional training of swallowing
Discharge	Nutritional guidance that matched the state of the nutrition, the feeding/swallowing function	The guidance for the prevention of suffocation and aspiration and the teaching training for the improvement of the speech, feeding/swallowing function at the home	Oral hygiene instruction after discharge

evaluation and rehabilitation of oral cancer patients with eating and swallowing disorders by developing a multidisciplinary support system from the preoperative stage onwards (Table 3). A previous study described improvements in postoperative eating and swallowing functions achieved by providing patients with information on these conditions and conducting training during the preoperative phase<sup>20)</sup>. Similarly, oral and maxillofacial surgeons at the OCC with expertise in these disorders evaluate the patient's eating and swallowing functions before deciding how to operate, and they explain the potential postoperative disorders to the patients and their family members, in addition to providing rehabilitative training prior to surgery. Even after surgery, the surgeons evaluate the patient's daily nutritional intake and eating/swallowing functions, in collaboration with certified nutritionists and speech language pathologists, and perform video endoscopy or videofluorography as necessary. Direct training and oral feeding are commenced

immediately when feasible, and steps are taken to improve the patient's dietary pattern. Because only a few health care facilities have such a specialized, multidisciplinary system and a substantial number of suitable patients<sup>15)</sup>, investigating the eating and swallowing disorders of postoperative oral cancer patients at the OCC and identifying the associated risk factors are important not only to demonstrate the usefulness of such a system in treating these disorders, but also to examine their characteristics and develop appropriate support methods for oral cancer patients with these disorders.

The mean age of the patients in this study was  $67.3 \pm 13.7$  years, which was relatively higher than that in previous studies<sup>12)</sup>. The severity of symptoms as indicated by preoperative cancer stage was more or less equally distributed among the study population. The majority of patients had malignant tumors in the tongue, followed by the lower jaw, making them suitable candidates for studying postoperative swallowing disorders based on previ-

ous findings that these disorders typically occur following surgery for tumors in the tongue and mandible<sup>10,19</sup>.

Despite reports by previous studies that approximately 30% of oral cancer patients did not achieve oral feeding<sup>15</sup>, that further surgery was required to improve postoperative deglutition<sup>1</sup>, and that approximately 30% of patients developed aspiration pneumonia<sup>12</sup>, only a single patient in the present study required a combination of oral and gastrostomy tube feeding at the time of discharge from the OCC, while the remaining 74 patients had all achieved complete oral feeding at discharge. Furthermore, none of the patients developed aspiration pneumonia or any other type of pneumonia up to the time of discharge. The mean time until starting direct training was  $15.2 \pm 13.1$  days, and the mean time until starting oral feeding was  $16.3 \pm 14.3$  days, which was short, even when compared to the results of a previous study<sup>8</sup>. This result attests to the efficacy of the OCC in treating eating and swallowing disorders based on an organized, multidisciplinary approach specializing in oral cancer and involving the collaboration of a team of physicians consisting of oral and maxillofacial surgeons, radiologists, and plastic and reconstructive surgeons, as well as paramedical personnel including nurses, pharmacists, speech language pathologists, and dental hygienists.

Factors having a significant impact on postoperative eating and swallowing functions were preoperative T score, preoperative N score, preoperative cancer stage, tumor resection range, tracheotomy method, and reconstructive surgery method; these resemble the findings of previous studies. On logistic regression analysis, preoperative cancer stage was the only factor recognized as having a significant impact. Tumor resection range and reconstructive surgery method probably proved to be significant factors because the OCC's treatment of eating and swallowing disorders is performed by experienced oral surgeons, while tracheotomy was probably a significant factor due to efforts to expedite

extubation, as well as the use of minimally invasive tracheotomy kits (Neo Perc<sup>®</sup>).

The number of geriatric oral cancer patients in Japan is set to increase as the nation's aging population continues to grow<sup>4</sup>. Therefore, in order to maintain QOL and prevent aspiration pneumonia among these patients, eating and swallowing disorders need to be treated in a more multidisciplinary manner based on greater cooperation with other medical professionals and community health care providers.

Since treatment of oral cancer has a considerable impact on eating and swallowing function, multidisciplinary intervention by various professionals needs to be established from the preoperative stage onwards. The Tokyo Dental College Oral Cancer Center aims to contribute to the development of dental medicine by enhancing oral cancer diagnosis and treatment standards and providing advanced multidisciplinary treatment in the fields of dentistry and medicine. Based on the findings of the present study, we intend to undertake and publish further investigation to establish treatment modalities for oral cancer patients with eating and swallowing disorders.

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