Oral Oncology 129 (2022) 105879

Contents lists available at ScienceDirect

Oral Oncology

journal homepage: www.elsevier.com/locate/oraloncology

Discrepancy between subjective and objective postoperative oral dysfunction assessment after oral cancer treatment: A single-center cross-sectional study

Akira Kato, Yuhei Matsuda *, Reon Morioka, Tatsuo Okui, Satoe Okuma, Hiroto Tatsumi, Takahiro Kanno

Department of Oral and Maxillofacial Surgery, Shimane University Faculty of Medicine, Izumo, Shimane, Japan

ARTICLE INFO

Keywords:
Oral cancer
Oral function
Dysphagia
Poor oral hygiene
Oral dryness
Reduced occlusal force
Decreased tongue pressure
Decreased masticatory function
Deterioration of swallowing function
POD-10

ABSTRACT

Objectives: It has been reported that in many cancer types, the evaluation of complications and side effects of treatment differs between subjective and objective evaluations. The purpose of this study is to verify whether the evaluation of postoperative oral dysfunction following oral cancer treatment was consistent subjective and objective evaluations.

Materials and Methods: This cross-sectional study collected background data and evaluated the oral function (microorganisms, oral dryness, occlusal force, tongue pressure, masticatory function and eating assessment tool [EAT-10]) of 75 patients from September 2019 to December 2021. The postoperative oral dysfunction-10 (POD-10) was used for the subjective assessment of dysfunction in oral cancer patients. Also, Matsuda-Kanno classification was used for the objective assessment. The kappa coefficient between POD-10 and oral dysfunction was calculated for the degree of agreement. The relationship between oral function measurements and POD-10 was examined by multiple regression analysis.

Results: The patients' median age was 72.0 (25–75 percentile: 64.0–78.0) and 69.3% were male. The kappa coefficients indicating the degree of agreement with POD-10 were 0.41 ($P < 0.01$) for occlusal force, 0.27 ($P = 0.01$) for masticatory function, and 0.59 ($P < 0.01$) for EAT-10. Multiple regression analysis showed a significant association of occlusal force ($\beta = -0.33$, $P = 0.03$) and EAT-10 ($\beta = 0.80$, $P < 0.01$) with POD-10.

Conclusions: For postoperative oral dysfunction type III (occlusal type), the evaluations of subjective and objective evaluations tended to be consistent. However, for type I (transport type) and II (oral hygiene type), these evaluations may be prone to overestimation or underestimation by either the medical professional or the patient.

Introduction

The Common Terminology Criteria for Adverse Events (CTCAE), now updated to version 5.0, is a system for medical professionals to evaluate complications and side effects associated with cancer treatment as objective evaluations [1]. With the development of a patient-reported version of its PRO-CTCAE in 2008, patients' subjective assessment of treatment has become easier and more generalized, facilitating better communication between health providers and patients [2]. Despite the potentially increasing importance of subjective evaluations, there are many reports of inconsistent evaluations between subjective and objective evaluations. A study assessing the quality of life (QoL) of patients treated for prostate cancer reported that physician assessment was irrelevant [3]. In a randomized controlled trial of patients undergoing chemotherapy for breast cancer, physicians underestimated patients' subjective assessment of chemotherapy-induced peripheral neuropathy [4], and a study in which patients and physicians assessed the QoL of patients receiving palliative care concluded that physicians should not make subjective patient assessments [5]. In addition, two studies on physician-patient assessment of adverse effects in chemoradiotherapy of head and neck cancers, including oral cancer, reported that physicians tended to underestimate toxicity assessment [6,7]. On the other hand,

* Corresponding author at: Department of Oral and Maxillofacial Surgery, Shimane University Faculty of Medicine, 89-1 Enya-cho, Izumo, Shimane 693-8501, Japan.
E-mail address: yuhei@med.shimane-u.ac.jp (Y. Matsuda).

https://doi.org/10.1016/j.oraloncology.2022.105879
Received 25 January 2022; Received in revised form 23 March 2022; Accepted 19 April 2022
Available online 25 April 2022

our previous study reported that the swallowing assessment and QoL assessment of patients who underwent surgery for oral cancer were generally associated. Based on the above, the differences between subjective and objective assessments of oral function in oral cancer patients are controversial [8].

One of the reasons for the difficulty of research on the relationship between subjective and objective assessments of oral cancer patients is the diversity of oral functions. Although the term "oral cancer" can be summarized as a single term, it includes disorders affecting different parts of the body, such as the tongue, palate, and gingiva, thus inconsistent evaluation methods are used across studies [9,10]. However, a uniform evaluation method for oral function has been recently established [11], which our research team applied to patients treated for oral cancer succeeding in classifying their disability after oral cancer treatment into three types as Matsuda-Kanno classification [12]. This oral function measurement and classification of postoperative oral dysfunction can help to provide an objective and comprehensive understanding of oral function and to understand its relationship to the subjective assessment of patients treated for oral cancer.

Therefore, we hypothesized that the agreement between subjective and objective evaluations in assessing postoperative oral dysfunction would differ by category. Thus, this study aimed to verify whether the evaluation of postoperative oral dysfunction following evidence-based oral cancer treatment is consistent between subjective and objective evaluations.

Material and methods

Patients enrollment

This study was a single-center cross-sectional study; patients meeting the following criteria were enrolled: [1] diagnosis of oral squamous cell carcinoma, [2] admitted to the Department of Oral and Maxillofacial Surgery/Oral Care Center, Shimane University Hospital (Shimane, Japan) for evidence-based oral cancer treatment guided by National Comprehensive Cancer Network (NCCN) guidelines by a single surgical team in a single center, [3] older than or equal 20 years of age and able to receive explanations and provide consent on their own, and [4] able to understand the intent of the questions and answer the questionnaire by themselves. No exclusion criteria for patient enrollment were established. The timing of data collection for all patients was right before discharge. The patient enrollment period was from September 2019 to December 2021, and a sequential sampling method was adopted. This study was conducted with the approval of the Institutional Review Board of the Ethics Committee of Shimane University Faculty of Medicine (number 4041). Written informed consent was obtained from each participant before enrollment.

Patients characteristics

We collected the following patient characteristics: sex, age (years), body mass index (BMI, kg/m^2), drinking habit (regular drinker or not), Brinkman index, Eastern Cooperative Oncology Group performance status, primary tumor site, cancer stage based on the criteria of Union for International Cancer Control (version 8), treatment methods (surgery/surgery and adjuvant chemotherapy/surgery and adjuvant chemoradiotherapy), presence of neck dissection, presence of reconstructive surgery, number of teeth.

Oral function measurement

As in our previous study, data collection for oral function measurement as the objective evaluations was conducted in accordance with the position paper of the Japanese Society of Gerontology [11,12]. However, as tongue-lip motor function could not be assessed in patients with tongue defects caused by oral cancer treatment, it was removed from the items to be assessed.

Microorganisms

The oral bacterial count was measured using a bacterial counter (Panasonic Healthcare Co., Ltd.) by touching a 1 cm sample from the dorsum of the tongue using a constant pressure measuring applicator. If the tongue was excised by surgery, specimens were collected from the remaining tongue. If all the tongue was excised, the specimen was collected from the center of the flap.

Oral dryness

For oral dryness, data on the dorsum of the tongue was collected three times using an oral moisture checker (Mucus, Life Co., Ltd.) and the median value registered as data. If the tongue was excised by surgery by surgery, data were collected from the remaining tongue. If all the tongue was excised, data were collected from the center of the flap.

Occlusal force

The occlusal force was measured using a special pressure sensitive paper (Dental Prescale Occluzer, GC Co.) and occluding with maximum force at the intercuspal position for 3 s; then, the data were captured and analyzed by a computer. For patients with dentures, if possible, measurements were performed with the denture in place.

Tongue pressure

Tongue pressure was measured using a JMS tongue pressure measuring instrument (TPM-01, JMS Co., Ltd.) and the maximum pressure on the dorsum of the tongue was registered. In cases where the tongue was replaced by a flap, measurements were performed in the center of the flap.

Masticatory function

For masticatory function, gummy jelly was chewed for 20 s, rinsed with 10 mL of water, and the sugar eluted in the water was measured using the masticatory ability testing system (Gluco Sensor GS- II, GC Corporation).

Eating assessment tool

Swallowing function was assessed by the Eating Assessment Tool (EAT-10) developed by Belafsky et al. [13]. The EAT-10 consists of 10 questions on a 5-point Likert scale (0 = no problem; 4 = severe problem), scored with a maximum score of 40 and a minimum of 0. The higher the total score, the worse the swallowing function.

Swallowing function measurement

Functional oral intake scale

Functional oral intake scale (FOIS) is a simple index as the objective evaluations for assessing swallowing function by grading the texture of the current meal into seven levels. The higher the FOIS grade, the better the swallowing function [14].

Postoperative oral dysfunction Scale-10

The postoperative oral dysfunction scale-10 (POD-10) is a questionnaire previously developed by our research team that can be used to subjectively assess oral function after oral cancer treatment. The POD-10 consists on 10 questions and can be rated on a 5-point Likert scale (0 = no problem; 4 = severe problem), with a maximum score of 40 and a minimum of 0. According to the literature, the cutoff value was set at 24 points, and patients with POD-10 greater than or equal to 24 points were included in the High POD-10 group and those with POD-10 less than 24 points were considered the Low POD-10 group [15]. The higher the total POD-10, the worse the oral function.

Matsuda-Kanno classification

The Matsuda-Kanno classification was used to assess postoperative oral dysfunction (Table 1). It recognizes three types (type I: transport type, type II: oral hygiene type, type III: occlusal type); symptoms were evaluated with reference to the cutoff values of oral function measurements [12].

Statistical analysis

Descriptive statistics were expressed as number of patients (%) or median (25–75 percentile) after normality was verified by the Shapiro-Wilk test. Group comparisons were performed using the chi-square test for categorical variables and the Mann-Whitney's *U* test for continuous variables. The association between POD-10 and each oral function measurement was calculated by Spearman's rank correlation coefficient and the kappa coefficient as a concordance test. Finally, multiple regression analysis was used to examine the relationship between each oral function measurement and POD-10 after adjusting for confounding factors with POD-10 as objective variable. Statistical analyses were performed using SPSS version 26 (SPSS Japan Inc., Tokyo, Japan). We calculated two-tailed P-values for all analyses, and the alpha level of significance was set at $P < 0.05$.

Results

Patient characteristics

Seventy-five post-treatment oral cancer patients (52 males [69.3%] and 23 females [30.7%]) were enrolled in the study. The median age was 72.0 years (64.0–78.0), the most frequent primary tumor site was the tongue in 31 cases (41.3%), and it was advanced cancer (stage III and IV) in 49 cases (65.3%). Neck dissection was performed in 48 (64.0%) patients and reconstructive surgery with flap in 47 (62.7%) patients. Details of patient characteristics and oral function measurements are summarized in Table 2.

Group comparisons of POD-10 score and related factors

Each score item was compared between the High POD-10 and Low POD-10 groups; there was a significant difference in the number of teeth, existence of pulmonary disease, performance status, tumor stage, adjuvant therapy, neck dissection, occlusal force, masticatory function and EAT-10 ($P < 0.05$). Group comparisons of POD-10 score and related factors are shown in Table 3.

Table 1
Matsuda-Kanno classification of postoperative oral dysfunction and cut-off values for oral function measurements.

Types	Names	Definition	Reference values for diagnostic criteria
I	Transport type	A condition in which dysfunction occurs during the oral preparatory and transit phases of swallowing due to treatment-induced damage to the tongue, palate, buccal mucosa, or oral floor.	Masticatory function (cut-off value: 83 mg/dl)EAT-10 (cut-off value: 12)Tongue pressure (cut-off value: 14 kPa)
II	Oral hygiene type	Conditions in which the self-cleaning and antibacterial moisturizing functions of the oral cavity are impaired by treatment.	Number of microorganisms (cut-off value: $10^{6.5}$ or more)Oral dryness (cut-off value: 27.0) Chief complaint of subjective oral health perception
III	Occlusion type	Conditions in which occlusion is impaired due to loss of maxilla and mandibular or teeth from treatment.	Occlusal force (cut-off value: 230 N)

Table 2
Demographic and clinical characteristics (N = 75).

Variables	Categories	N (%), median (25–75 percentile)
Sex	Male	52 (69.3)
	Female	23 (30.7)
Age (years)		72.0 (64.0–78.0)
Body mass Index (kg/m^2)		20.4 (18.6–23.6)
Brinkman Index		0.0 (0.0–440.0)
Drinking	Regular drinker	34 (45.3)
	Social drinker	7 (9.3)
	None	34 (45.3)
Number of teeth		16.0 (3.0–24.0)
Systemic disease	Diabetes mellitus	17 (22.7)
	Hypertension	27 (36.0)
	Cardiovascular disease	8 (10.7)
	Cerebrovascular disease	5 (6.7)
	Liver disease	4 (5.3)
	Pulmonary disease	8 (10.7)
	Kidney disease	5 (6.7)
	Orthopedic disease	8 (10.7)
	Psychiatric disease	6 (8.0)
	Cancer excepting oral cancer	6 (8.0)
Performance status	0	59 (78.7)
	1	9 (12.0)
	2	1 (1.3)
	3	6 (8.0)
Primary tumor sites	Tongue	31 (41.3)
	Upper gingiva	16 (21.3)
	Lower gingiva	16 (21.4)
	Plate	3 (4.0)
	Oral floor	5 (6.7)
	Buccal	3 (4.0)
	Lip	1 (1.3)
Tumor Stage	Stage I	17 (22.7)
	Stage II	9 (12.0)
	Stage III	12 (16.0)
	Stage IV	37 (49.3)
Treatment	Surgery	40 (53.3)
	Surgery + Radiotherapy	10 (13.3)
	Surgery + Chemoradiotherapy	25 (33.3)
Neck dissection		48 (64.0)
Reconstruction		47 (62.7)
Oral function measurement	Microorganisms (Grade)	3.0 (2.0–5.0)
	Oral dryness	24.8 (21.3–26.7)
	Occlusal force (N)	245.6 (18.0–443.6)
	Tongue pressure (kPa)	17.1 (7.5–23.6)
	Masticatory function (mg/dl)	75.0 (15.0–150.0)
	EAT-10	15.0 (4.0–25.0)
Functional oral intake scale	1	6 (8.0)
	2	4 (5.3)
	3	0 (0.0)
	4	8 (10.7)
	5	22 (29.3)
	6	25 (33.3)
	7	10 (13.3)
POD-10		19.0 (9.0–26.0)

EAT-10: eating assessment tool-10; POD-10: postoperative oral dysfunction scale-10.

Relationship between POD-10 and oral function measurements

There were significant relationships between POD-10 and occlusal force ($r = -0.43$, $P < 0.01$), masticatory function ($r = -0.40$, $P < 0.01$), and EAT-10 ($r = 0.86$, $P < 0.01$). Other oral function measurements showed no significant relationship with the EAT-10. Fig. 1 illustrates the relationship between POD-10 and oral function measurements.

Table 3
Group comparisons of POD-10 and related factors (N = 75).

Variables	Categories	POD-10 (N [%] or Median [25–75 percentile])		
		Low POD-10	High POD-10	P-value
Sex	Male	35 (46.7)	17 (22.7)	0.61
	Female	14 (18.7)	9 (12.0)	
Age (years)		72.0 (65.0–76.5)	72.5 (61.8–80.5)	0.79
Body mass index (kg/m^2)		21.1 (18.6–23.7)	19.5 (17.4–22.8)	0.32
Brinkman index		0.0 (0.0–310.0)	100.0 (0.0–725.0)	0.25
Drinking	Regular drinker	20 (26.7)	14 (18.7)	0.11
	Social drinker	7 (9.3)	0 (0)	
	None	22 (29.3)	12 (16.0)	
Number of teeth		20.0 (8.5–25.5)	7.5 (0.0–22.0)	0.04*
Systemic disease	Diabetes mellitus	10 (13.3)	7 (9.3)	0.57
	Hypertension	15 (20.0)	12 (16.0)	0.21
	Cardiovascular disease	5 (6.7)	3 (4.0)	1.00
	Cerebrovascular disease	2 (2.7)	3 (4.0)	0.33
	Liver disease	3 (4.0)	1 (1.3)	1.00
	Pulmonary disease	2 (2.7)	6 (8.0)	0.02*
	Kidney disease	3 (4.0)	2 (2.7)	1.00
	Orthopedic disease	4 (5.3)	4 (5.3)	0.44
	Psychiatric disease	3 (4.0)	3 (4.0)	0.41
	Cancer excepting oral cancer	5 (6.7)	1 (1.3)	0.66
Performance status		0.0 (0.0–0.0)	0.0 (0.0–1.0)	0.01*
Primary tumor sites	Tongue	19 (25.3)	12 (16.0)	0.63
	Gingiva	19 (25.3)	11 (14.7)	0.81
	Others	11 (14.7)	3 (4.0)	0.36
Tumor Stage		3.0 (1.0–4.0)	4.0 (4.0–4.0)	<0.01*
Adjuvant therapy		17 (22.7)	22 (29.3)	<0.01*
Neck dissection		26 (34.7)	22 (29.3)	0.01*
Reconstruction		29 (38.7)	18 (24.0)	0.46
Oral function measurement	Microorganisms (Grade)	3.0 (2.0–4.0)	3.5 (2.8–5.0)	0.35
	Oral dryness	24.9 (21.1–26.7)	24.7 (21.2–26.5)	0.63
	Occlusal force (N)	324.8 (198.8–594.6)	45.0 (0.0–253.6)	<0.01*
	Tongue pressure (kPa)	17.1 (9.2–25.4)	16.3 (3.5–21.6)	0.31
	Masticatory function (mg/dl)	97.0 (37.5–168.5)	26.5 (8.8–117.3)	0.01*
	EAT-10	7.0 (2.0–16.0)	28.0 (23.5–32.5)	<0.01*

POD-10: postoperative oral dysfunction-10.

Concordance test for the association between POD-10 and each oral function measurement

A significant agreement with the POD-10 diagnosis was found for occlusal force (kappa coefficient = 0.41, P < 0.01), masticatory function (kappa coefficient = 0.27, P = 0.01), and EAT-10 (kappa coefficient = 0.59, P < 0.01). Detailed results of the concordance test are shown in Table 4.

Relationship between POD-10 and oral function measurement using multiple regression analysis

Multiple regression analysis showed a significant association with POD-10 of occlusal force (β = -0.33, P = 0.03) and EAT-10 (β = 0.80, P < 0.01; Table 5).

Discussion

The major findings of this study are that while there may be agreement between subjective and objective evaluations in postoperative oral dysfunction type III (occlusal type), this might not be the case for type I (transport type) and II (oral hygiene type) postoperative oral dysfunction. A previous study suggested three possible reasons for underestimation by medical professionals: 1. medical professionals may not pay attention to subjective adverse events; 2. medical professionals may not report adverse events they consider unrelated to treatment; and 3. they may be less concerned about symptoms widely recognized to be related to treatment [16]. Type III is most likely to occur in tooth loss and defects of maxilla and mandible due to resection of gingival cancer, and oral-maxillofacial prosthetic treatment is often recommended [9]. The correlation and kappa coefficients of Type III are high because it is a visible disorder and medical professionals can easily recognize that it is related to treatment.

On the other hand, Type I is considered a disorder in stage I transport (pull back motion of the food from the anterior to the molar region of the mouth), processing (mastication and mixing of triturated food with saliva) and stage II transport (squeeze back motion of the processed food from the mouth to the pharynx) phases as described in the process model of swallowing [17]. Although Type I, which is a disorder of continuous motion, can be confirmed by swallowing videofluorography [18], it can only be detected as a fragmented and non-visible disorder by oral function measurements alone. This may explain the discrepancy. In addition, Loni et al. reported a disconnect between patient's perception and swallowing pathophysiology for head and neck cancer patients including oral cancer [19]. The process of swallowing consists of a very complex physiology and is generally considered to result from the coordinated action of six cranial nerves, multiple muscle groups, and cortical and subcortical brain signals [20]. Above all, this motion is a mixture of voluntary and involuntary movements, which makes it difficult to evaluate for both patients and medical professionals [21]. Among the three tests in Type I, masticatory function and tongue pressure showed low correlation and kappa coefficients and no association in multiple regression analysis, while EAT-10 showed a strong association and concordance in all three tests, suggesting that evaluation using multiple modalities is important for the diagnosis of Type I [22]. In addition, it is reasonable that Type I consists of both subjective and objective items, and it is recommended to use POD-10 instead of EAT-10 when the primary tumor site is in the oral cavity.

Type II also showed a discrepancy between subjective and objective ratings from each analysis. A study of 650 randomly selected healthy individuals reported a discrepancy between the oral hygiene needs considered by healthcare providers and those considered by the subjects, suggesting that patients may overestimate their own oral hygiene in Type II, unlike Type I and III [23]. However, while Type II is rarely a direct problem, it is an important issue because oral hygiene after oral cancer treatment might affect the incidence of aspiration pneumonia and even mortality [24]. The difficulty in dealing with Type II in particular is the need for close oral hygiene evaluation and care even after the acute phase and the transition to community care. In fact, regular dental visits after head and neck, oral cancer treatment are significantly associated with overall survival [25]. Therefore, medical professionals should create an environment that can provide seamless medical cooperation from acute care to community care for patients with Type II diagnosis. In addition, it has been pointed out that oral and maxillofacial surgeons with dental background and head and neck surgeons with otolaryngology background might have different perspectives in treatments of oral cancer [26]. Thus, it is necessary to consider a possibility that differences in professions may have affected evaluation of mastication and swallowing in particular.

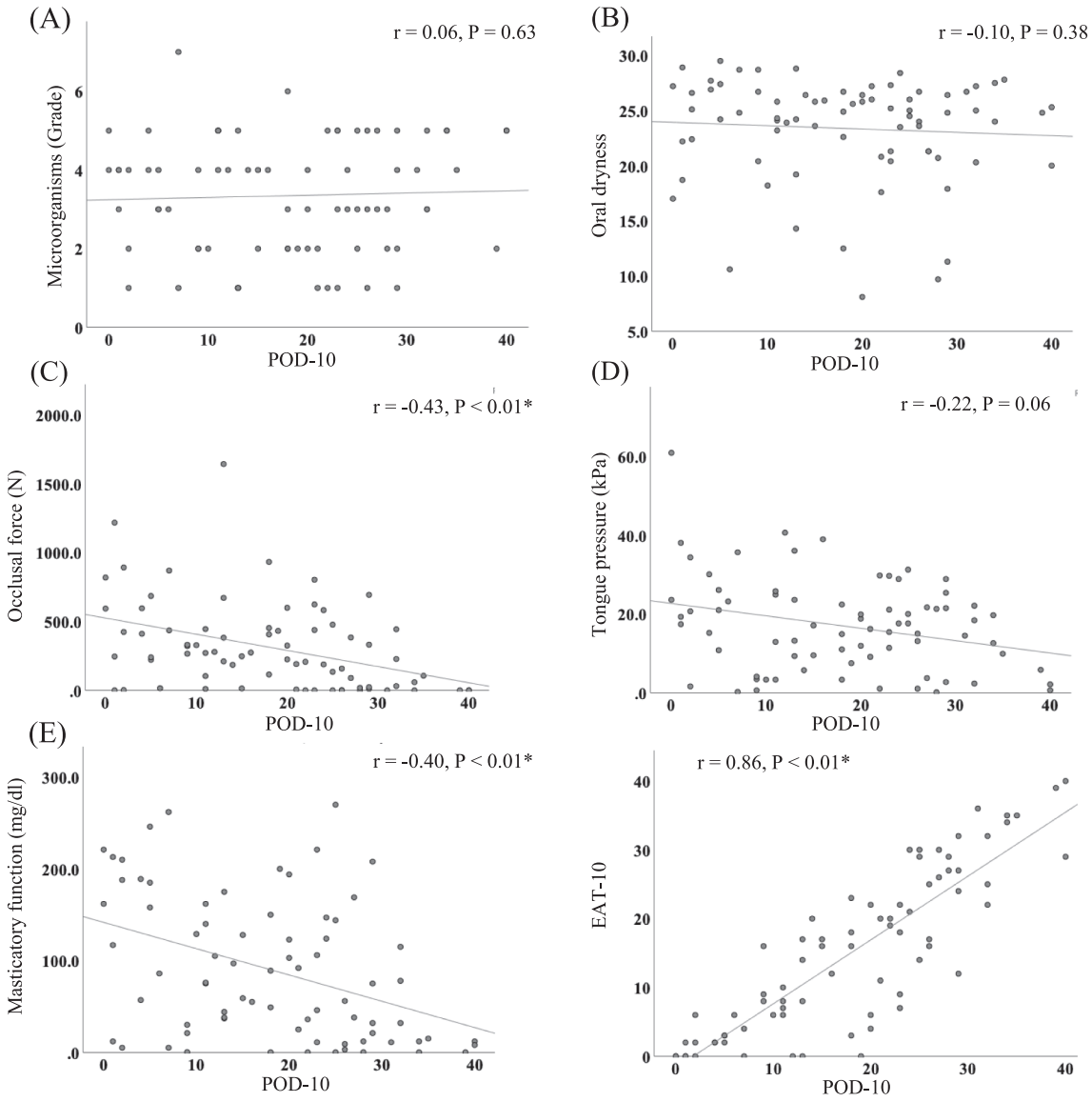

Fig. 1. Scatter plot of the relationship between POD-10 and each oral function measurement (A) Microorganisms, (B) Oral dryness, (C) Occlusal force, (D) Tongue pressure, (E) Masticatory function, (F) EAT-10.

Table 4
Discrepancy between POD-10 and each oral function measurement using kappa coefficient.

Variables	Categories	POD-10 (N [%])		κ coefficient	P-value
		Dysfunction (Low POD-10)	Function (High POD-10)		
Microorganisms (Grade)	Function	25 (33.3)	13 (17.3)	0.01	0.93
	Dysfunction	24 (32.0)	13 (17.3)		
Oral dryness	Function	10 (13.3)	4 (5.3)	0.04	0.60
	Dysfunction	39 (52.0)	22 (29.3)		
Occlusal force (N)	Function	33 (44.0)	6 (8.0)	0.41	<0.01*
	Dysfunction	16 (21.3)	20 (26.7)		
Tongue pressure (kPa)	Function	29 (38.7)	15 (20.0)	0.01	0.90
	Dysfunction	20 (26.7)	11 (14.7)		
Masticatory function (mg/dl)	Function	28 (37.3)	7 (9.3)	0.27	0.01*
	Dysfunction	21 (28.0)	19 (25.3)		
EAT-10	Function	33 (44.0)	0 (0)	0.59	<0.01*
	Dysfunction	16 (21.3)	26 (34.7)		

This study has two limitations: first, as it is a cross-sectional survey, it is unclear whether subjective and objective assessments will match over time after treatment; second, due to the small sample size, the number of confounders adjusted for in multivariate analysis was small. Thus, further longitudinal studies with a larger sample size are needed for more precise and reliable analysis.

Table 5
Relationship between POD-10 and oral function measurement using multiple regression analysis.

Variables	β	B	95% confident interval		P-value	Adjusted R^2
			Lower	Upper		
Microorganisms (Grade)	0.06	0.42	−1.18	2.01	0.60	0.21
Oral dryness	−0.09	−0.20	−0.70	0.30	0.43	0.21
Occlusal force (N)	−0.33	−0.01	−0.02	−0.001	0.03*	0.26
Tongue pressure (kPa)	−0.13	−0.12	−0.34	0.10	0.26	0.22
Masticatory function (mg/dl)	−0.23	−0.03	−0.07	0.01	0.11	0.23
EAT-10	0.80	0.74	0.61	0.87	<0.01*	0.73

For multiple regression analysis, the analyses for each oral function were separated due to multi-collinearity, and sex, age, pulmonary disease, number of teeth, tumor stage and primary tumor site were simultaneously forced into the model equation for each analysis to adjust for confounding factors. POD-10: postoperative oral dysfunction-10; β: standardized partial regression coefficient; B: partial regression coefficient; R^2: multiple regression coefficient.

Conclusion

In case of postoperative oral dysfunction type III (occlusal type), the subjective and objective evaluations tended to be consistent. On the other hand, type I (transport type) and II (oral hygiene type) may be prone to overestimation or underestimation by either the subjective or objective evaluations. Therefore, medical professionals should pay attention to patient complaints following oral cancer treatment.

Compliance with ethical standards

Informed consent: Written informed consent was obtained from all participants before their participation in the study.

Funding

This research was funded by JSPS KAKENHI (Grant Number 20K18829).

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

We would like to express our appreciation to all the staff members of the Department of Oral and Maxillofacial Surgery of Shimane University.

References

[1] Trotti A, Colevas AD, Setser A, Rusch V, Jaques D, Budach V, et al. CTCAE v3.0: development of a comprehensive grading system for the adverse effects of cancer treatment. Semin Radiat Oncol 2003;13:176–81.
[2] Bruner DW, Hanisch LJ, Reeve BB, Trotti AM, Schrag D, Sit L, et al. Stakeholder perspectives on implementing the National Cancer Institute's patient-reported outcomes version of the Common Terminology Criteria for Adverse Events (PRO-CTCAE). Transl Behav Med 2011;1:110–22.
[3] Sonn GA, Sadetsky N, Presti JC, Litwin MS. Differing perceptions of quality of life in patients with prostate cancer and their doctors. J Urol 2013;189:S59–65. discussion S65.
[4] Shimozuma K, Ohashi Y, Takeuchi A, Aranishi T, Morita S, Kuroi K, et al. Feasibility and validity of the Patient Neurotoxicity Questionnaire during taxane chemotherapy in a phase III randomized trial in patients with breast cancer: N-SAS BC 02. Support Care Cancer 2009;17:1483–91.
[5] Petersen MA, Larsen H, Pedersen L, Sonne N, Groenvold M. Assessing health-related quality of life in palliative care: comparing patient and physician assessments. Eur J Cancer 2006;42:1159–66.
[6] Falchook AD, Green R, Knowles ME, Amdur RJ, Mendenhall W, Hayes DN, et al. Comparison of Patient- and Practitioner-Reported Toxic Effects Associated With Chemoradiotherapy for Head and Neck Cancer. JAMA Otolaryngol Head Neck Surg 2016;142:517–23.
[7] Hollander-Mieritz C, Johansen J, Johansen C, Vogelius IR, Kristensen CA, Pappot H. Comparing the patients' subjective experiences of acute side effects during radiotherapy for head and neck cancer with four different patient-reported outcomes questionnaires. Acta Oncol 2019;58:603–9.
[8] Matsuda Y, Kanazawa M, Komagamine Y, Yamashiro M, Akifusa S, Minakuchi S. Reliability and Validity of the MD Anderson Dysphagia Inventory Among Japanese Patients. Dysphagia 2018;33:123–32.
[9] Ohashi Y, Shiga K, Katagiri K, Saito D, Oikawa SI, Tsuchida K, et al. Evaluation and comparison of oral function after resection of cancer of the upper gingiva in patients who underwent reconstruction surgery versus those treated with a prosthesis. BMC Oral Health 2021;21:347.
[10] Dholam KP, Dugad JA, Sadashiva KM. Impact of oral rehabilitation on patients with head and neck cancer: A study using the Liverpool Oral Rehabilitation Questionnaire and the Oral Health Impact Profile-14. J Prosthet Dent 2017;117:559–62.
[11] Minakuchi S, Tsuga K, Ikebe K, Ueda T, Tamura F, Nagao K, et al. Oral hypofunction in the older population: Position paper of the Japanese Society of Gerodontology in 2016. Gerodontology 2018;35:317–24.
[12] Matsuda Y, Okui T, Karino M, Aoi N, Okuma S, Hayashida K, et al. Postoperative oral dysfunction following oral cancer resection and reconstruction: A preliminary cross-sectional study. Oral Oncol 2021;121:105468.
[13] Belafsky PC, Mouadeb DA, Rees CJ, Pryor JC, Postma GN, Allen J, et al. Validity and reliability of the Eating Assessment Tool (EAT-10). Ann Otol Rhinol Laryngol 2008;117:919–24.
[14] Ihara Y, Tashimo Y, Nozue S, Iizumi Y, Fukunishi Y, Saito Y, et al. Changes in Oral Function and Quality of Life in Tongue Cancer Patients Based on Resected Area. Asian Pac J Cancer Prev 2021;22:2549–57.
[15] Matsuda Y, Kumakura I, Okui T, Karino M, Aoi N, Okuma S, et al. Development of a Subjective Symptom Rating Scale for Postoperative Oral Dysfunction in Patients with Oral Cancer: Reliability and Validity of the Postoperative Oral Dysfunction Scale-10. Diagnostics (Basel) 11, 2021.
[16] Di Maio M, Gallo C, Leighl NB, Piccirillo MC, Daniele G, Nuzzo F, et al. Symptomatic toxicities experienced during anticancer treatment: agreement between patient and physician reporting in three randomized trials. J Clin Oncol 2015;33:910–5.
[17] Palmer JB. Bolus aggregation in the oropharynx does not depend on gravity. Arch Phys Med Rehabil 1998;79:691–6.
[18] Vansant MB, Parker LA, McWhorter AJ, Bluoin D, Kunduk M. Predicting Swallowing Outcomes from Objective Videofluoroscopic Timing and Displacement Measures in Head and Neck Cancer Patients. Dysphagia 2020;35:853–63.
[19] Arrese LC, Schieve HJ, Graham JM, Stephens JA, Carrau RL, Plowman EK. Relationship between oral intake, patient perceived swallowing impairment, and objective videofluoroscopic measures of swallowing in patients with head and neck cancer. Head Neck 2019;41:1016–23.
[20] van der Bilt A, Engelen L, Pereira LJ, van der Glas HW, Abbink JH. Oral physiology and mastication. Physiol Behav 2006;89:22–7.
[21] Sasegbon A, Hamdy S. The anatomy and physiology of normal and abnormal swallowing in oropharyngeal dysphagia. Neurogastroenterol Motil 2017;29.
[22] Pedersen A, Wilson J, McColl E, Carding P, Patterson J. Swallowing outcome measures in head and neck cancer–How do they compare? Oral Oncol 2016;52:104–8.
[23] Lundegren N, Axtelius B, Hakansson J, Akerman S. Dental treatment need among 20 to 25-year-old Swedes: discrepancy between subjective and objective need. Acta Odontol Scand 2004;62:91–6.
[24] Xu B, Boero IJ, Hwang L, Le QT, Moiseenko V, Sanghvi PR, et al. Aspiration pneumonia after concurrent chemoradiotherapy for head and neck cancer. Cancer 2015;121:1303–11.
[25] Chang CC, Lee WT, Hsiao JR, Ou CY, Huang CC, Tsai ST, et al. Oral hygiene and the overall survival of head and neck cancer patients. Cancer Med 2019;8:1854–64.
[26] Berrone M, Lajolo C, De Corso E, Settimi S, Rupe C, Crosetti E, et al. Cooperation between ENT surgeon and dentist in head and neck oncology. Acta Otorhinolaryngol Ital 2021;41:S124–37.