Online ISSN 2663-8290

Research Article

Academia Journal of Medicine
Vol. 9, No. 1, January–June 2026

Comparative Assessment of Tmj Dysfunction in Oral Cancer Patients Undergoing Mandibular Reconstruction

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https://doi.org/10.48165/ajm.2026.9.01.50

ARTICLE INFO

Article history
Received: 2026
Accepted: 2026

Keywords
Oral Cancer
Mandibular Reconstruction
Temporomandibular Joint Dysfunction
TMJ
Mouth Opening
Functional Outcome
Radiotherapy
Quality of Life

ABSTRACT

Oral cancer patients undergoing mandibular reconstruction frequently experience alterations in mandibular biomechanics that may lead to temporomandibular joint (TMJ) dysfunction and compromised oral function. This study aimed to comparatively assess TMJ dysfunction in oral cancer patients following mandibular reconstruction. Sixty patients were clinically evaluated for TMJ-related symptoms, including mouth opening, mandibular deviation, joint tenderness, and pain, and the findings were analyzed according to reconstruction type and treatment-related factors. TMJ dysfunction was observed in the majority of patients, with reduced mouth opening being the most common finding, while greater dysfunction was associated with extensive mandibular resection and postoperative radiotherapy. Early identification and rehabilitation of TMJ dysfunction may improve postoperative functional outcomes and quality of life in oral cancer survivors.

INTRODUCTION

Oral cancer is one of the most prevalent malignancies affecting the head and neck region and continues to be associated with significant morbidity and functional impairment. Surgical resection remains the primary treatment modality for many patients; however, extensive mandibular defects resulting from tumor excision often require reconstructive procedures to restore facial aesthetics, speech, mastication, and swallowing functions [1,2]. Advances in reconstructive surgery, particularly the use of vascularized free flaps and osseous grafts, have considerably improved survival rates and postoperative quality of life in these patients [3,4].

Despite these advances, functional rehabilitation following mandibular reconstruction remains challenging. One of the frequently overlooked complications is temporomandibular joint (TMJ) dysfunction, which may develop due to altered mandibular biomechanics, changes in occlusion, muscular imbalance, scar contracture, and postoperative fibrosis [5,6]. TMJ dysfunction may manifest as pain, joint sounds, restricted mouth opening, deviation during mandibular move-

ments, and difficulty in performing routine oral functions, thereby negatively affecting the patient's quality of life [7,8].

The integrity of the temporomandibular joint plays a crucial role in maintaining normal mandibular function. Surgical resection involving the mandible can disrupt the anatomical relationship between the condyle, masticatory muscles, and surrounding structures, resulting in altered joint mechanics and compromised function [9]. Furthermore, adjuvant therapies such as radiotherapy may contribute to fibrosis, trismus, and reduced mandibular mobility, further increasing the risk of TMJ-related complications [10].

Although numerous studies have evaluated oncological outcomes and reconstructive success following mandibular reconstruction, comparatively limited attention has been directed toward the assessment of TMJ dysfunction in these patients. Early identification and evaluation of TMJ disorders are essential for planning appropriate rehabilitative strategies and improving long-term functional outcomes. Therefore, the present study was undertaken to comparatively assess temporomandibular joint dysfunction in oral cancer patients undergoing mandibular reconstruction and to determine its impact on postoperative functional status and quality of life.

METHODOLOGY

This comparative cross-sectional study was conducted in the Department of Oral and Maxillofacial Surgery after obtaining approval from the Institutional Ethics Committee. Oral cancer patients who had undergone mandibular reconstruction following surgical resection were recruited from the outpatient and follow-up clinics of the institution. Written informed consent was obtained from all participants prior to their inclusion in the study.

A total of eligible patients who fulfilled the inclusion criteria were enrolled. Patients aged 18 years and above who had undergone mandibular reconstruction for oral cancer and had completed a minimum postoperative healing period of three months were included in the study. Patients with a previous history of temporomandibular joint disorders before cancer surgery, congenital craniofacial anomalies, neurological disorders affecting mandibular movements, recurrent malignancy, or incomplete clinical records were excluded.

Demographic and clinical information, including age, sex, primary tumor site, type of mandibular defect, reconstructive technique employed, and duration since surgery, were obtained from the patients' medical records. All participants underwent a comprehensive clinical examination for the assessment of temporomandibular joint dysfunction. Evaluation included measurement of maximum mouth opening using a calibrated digital vernier caliper, assessment of mandibular movements in all functional directions, detection of joint sounds during opening and closing movements, evaluation of mandibular deviation or deflection, and assessment of tenderness in the temporomandibular joint and associated masticatory muscles through palpation.

The severity of temporomandibular joint dysfunction was assessed using a standardized clinical assessment protocol based on established diagnostic criteria. Pain intensity was recorded using a Visual Analog Scale (VAS), while functional limitations related to mastication, speech, and mouth opening were documented through patient interviews and clinical examination. The presence of trismus was determined according to the maximum interincisal distance recorded during examination.

Patients were grouped according to the type of mandibular reconstruction performed, and the prevalence and severity of temporomandibular joint dysfunction were compared between the groups. All clinical examinations were carried out by a single calibrated examiner to minimize inter-examiner variability. The collected data were entered into a computerized database and analyzed using the Statistical Package for Social Sciences (SPSS) software version 26.0. Descriptive statistics were calculated for all variables. Continuous variables were expressed as mean ± standard deviation, whereas categorical variables were presented as frequencies and percentages. Intergroup comparisons were performed using the independent t-test, one-way analysis of variance (ANOVA), or Chi-square test as appropriate. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 60 oral cancer patients who had undergone mandibular reconstruction were included in the study. The demographic characteristics of the study population are presented in Table 1. The majority of the participants were male (70%), with a mean age of 54.3 ± 10.8 years. Most patients belonged to the 51–60 years age group.

The distribution of temporomandibular joint dysfunction findings is shown in Table 2. TMJ dysfunction was observed in 43 patients (71.7%). Reduced mouth

Table 1: Demographic characteristics of study participants (n = 60)

Variable	Frequency (n)	Percentage (%)
Male	42	70.0
Female	18	30.0
Age 31–40 years	8	13.3
Age 41–50 years	16	26.7
Age 51–60 years	24	40.0
Age >60 years	12	20.0

Table 2: Distribution of TMJ dysfunction findings

Clinical Finding	Frequency (n)	Percentage (%)
Reduced mouth opening	38	63.3
Mandibular deviation	31	51.7
Joint tenderness	24	40.0
Joint sounds	19	31.7
Pain during function	17	28.3

opening was the most common clinical finding, affecting 38 patients (63.3%), followed by mandibular deviation during opening in 31 patients (51.7%). Joint tenderness, joint sounds, and pain during mandibular function were observed in 24 (40.0%), 19 (31.7%), and 17 (28.3%) patients, respectively.

The comparison of mean maximum mouth opening among different reconstruction groups is presented in Table 3. Patients reconstructed with free fibular flaps demonstrated significantly greater mouth opening (35.2 ± 6.1 mm) compared with patients reconstructed using reconstruction plates (28.1 ± 6.8 mm). The difference was statistically significant ($p = 0.002$), indicating better functional outcomes in patients treated with vascularized bone reconstruction.

The severity of TMJ dysfunction among the study participants is shown in Table 4. Mild dysfunction was observed in 22 patients (36.7%), moderate dysfunction in 15 patients (25.0%), and severe dysfunction in 6 patients (10.0%). Only 17 patients (28.3%) exhibited no signs of TMJ dysfunction. These findings indicate that varying degrees of TMJ impairment were common following mandibular reconstruction.

The association between the type of mandibular resection and TMJ dysfunction severity is presented in Table 5. Patients who underwent segmental mandibular resection demonstrated significantly higher dysfunction scores compared with those who underwent marginal resection ($p = 0.01$). This suggests that more extensive surgical defects may adversely affect temporomandibular joint function.

The effect of postoperative radiotherapy on TMJ function is summarized in Table 6. Patients who received adjuvant radiotherapy exhibited significantly reduced mouth opening and higher dysfunction scores than those who did not receive radiotherapy ($p = 0.03$). These findings indicate that radiotherapy may contribute to functional limitation of the temporomandibular joint.

Correlation analysis between the extent of mandibular resection and maximum mouth opening is shown in Table 7. A significant negative correlation was observed ($r = -0.48$, $p = 0.001$), demonstrating that larger mandibular defects were associated with reduced mouth opening and greater functional impairment.

Overall, the findings revealed a high prevalence of temporomandibular joint dysfunction among oral cancer patients undergoing mandibular reconstruction. Reduced mouth opening, mandibular deviation, and joint tenderness were the most frequently observed clinical manifestations. Functional outcomes were significantly influenced by the reconstruction technique, extent of mandibular resection, and use of postoperative radiotherapy.

DISCUSSION

The restoration of mandibular continuity following oral cancer surgery is essential for maintaining facial symmetry, mastication, speech, swallowing, and overall quality of life. However, despite significant advancements in reconstructive techniques, temporomandibular joint (TMJ) dysfunction remains a common postoperative complication that may adversely affect functional recovery. The present study demonstrated a high prevalence of TMJ dysfunction among patients undergoing mandibular reconstruction, with reduced mouth opening, mandibular deviation, and joint tenderness being the most frequently observed clinical manifestations.

The high incidence of TMJ dysfunction observed in the present study is consistent with the findings of Tian et al. [11], who reported that surgical intervention and subsequent tissue remodeling can significantly affect mandibular biomechanics and joint function. Similarly, Roy Xiao et al. [12] emphasized that functional outcomes following oral cancer treatment should be considered as important as oncological control, as post-

Table 3: Comparison of maximum mouth opening among reconstruction groups

Reconstruction Type	Mean Mouth Opening (mm)	SD	p-value
Free fibular flap	**35.2**	**6.1**	
Reconstruction plate	**28.1**	**6.8**	**0.002***
Other reconstructions	**31.5**	**5.9**	

****Statistically significant***

Table 4: Severity of TMJ dysfunction

Severity	Frequency (n)	Percentage (%)
No dysfunction	**17**	**28.3**
Mild dysfunction	**22**	**36.7**
Moderate dysfunction	**15**	**25.0**
Severe dysfunction	**6**	**10.0**

operative impairments can substantially affect patient quality of life.

In the present study, reduced mouth opening was the most common finding. This observation is in agreement with the results of Schoonbeek et al. [13], who demonstrated that oral cancer survivors frequently experience persistent functional limitations, including trismus and reduced mandibular mobility, even after successful reconstruction. Burkhardt et al. [14] further reported that long-term oral rehabilitation remains challenging due to the complex interaction between surgical defects, reconstruction, and postoperative tissue adaptation.

Patients reconstructed with vascularized bone grafts exhibited better functional outcomes compared with those treated using reconstruction plates. Similar findings were reported by Ciocca et al. [15], who highlighted the advantages of biologically integrated reconstructive approaches in restoring mandibular function and improving postoperative oral performance. Hayden and Mullin [16] also emphasized that modern reconstructive techniques have substantially improved functional rehabilitation; however, complete restoration of normal TMJ function remains difficult in patients with extensive mandibular defects.

The present study found significantly greater TMJ dysfunction in patients who underwent segmental mandibular resection than in those treated with marginal resection. This may be attributed to greater disruption of mandibular continuity and altered biomechanical loading of the temporomandibular joint. Zhang et al. [17] similarly reported that the extent of mandibular resection is a major determinant of postoperative functional outcomes, with larger defects resulting in greater impairment of mandibular movement and joint function.

Postoperative radiotherapy was associated with significantly reduced mouth opening and increased TMJ dysfunction in the present study. These findings may be explained by radiation-induced fibrosis, muscular contracture, and reduced tissue elasticity. Comparable observations were reported by Salah et al. [18], who described the detrimental effects of adjuvant therapies on oral and maxillofacial function, particularly with respect to mandibular mobility and masticatory efficiency.

The significant negative correlation observed between the extent of mandibular resection and maximum mouth opening further supports the influence of defect size on postoperative functional performance. Similar conclusions were drawn by Shinde et al. [19], who reported that larger mandibular defects were associated with greater functional disability and increased rehabilitation requirements following oral cancer treatment.

The findings of the present study are also in accordance with those reported by Abboud et al. [20], who emphasized the importance of comprehensive survivorship care in oral cancer patients. Beyond oncological management, long-term assessment of functional outcomes, including TMJ health, is essential for optimizing rehabilitation and improving patient-reported quality of life.

Although the present study provides valuable information regarding TMJ dysfunction following mandibular reconstruction, certain limitations should be acknowledged. The study was conducted at a single center with a relatively limited sample size, which may affect the generalizability of the findings. In addition, long-term longitudinal assessment was not performed. Future multicenter studies with larger sample sizes and extended follow-up periods are recommended to further investigate the impact of reconstructive techniques on TMJ function and overall postoperative rehabilitation.

Within the limitations of the present study, it may be concluded that TMJ dysfunction is a common finding among oral cancer patients undergoing mandibular reconstruction. Reduced mouth opening, mandibular

Table 5: Association between type of mandibular resection and TMJ dysfunction

Type of Resection	Mean Dysfunction Score	SD	p-value
Marginal resection	1.9	0.8	
Segmental resection	3.1	1.1	0.01*

**Statistically significant*

Table 6: Effect of radiotherapy on TMJ function

Variable	Radiotherapy	No Radiotherapy	p-value
Mean mouth opening (mm)	28.4 ± 6.3	34.8 ± 5.9	0.03*
Mean dysfunction score	3.0 ± 1.1	2.1 ± 0.9	0.03*

**Statistically significant*

Table 7: Correlation between extent of mandibular resection and mouth opening

Variable	Correlation coefficient (r)	p-value
Extent of mandibular resection vs. mouth opening	-0.48	0.001*

**Statistically significant*

deviation, and joint tenderness were the most prevalent manifestations. The severity of dysfunction was influenced by the extent of mandibular resection, reconstruction modality, and postoperative radiotherapy, highlighting the need for early functional assessment and targeted rehabilitation strategies in this patient population.

CONCLUSION

TMJ dysfunction is a common postoperative complication in oral cancer patients undergoing mandibular reconstruction, with reduced mouth opening being the most frequent finding. The severity of dysfunction is influenced by the extent of mandibular resection, type of reconstruction, and postoperative radiotherapy. Early assessment and rehabilitation of TMJ function are essential to improve long-term functional outcomes and quality of life.

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How to Cite this Article: Rizvi D.A., Kujur D.J., Arora D.S., Dixit D.P.S., Mohapatra D.S., Pareek D.S.. (2026). Comparative Assessment of Tmj Dysfunction in Oral Cancer Patients Undergoing Mandibular Reconstruction. *Academia Journal of Medicine*, ***9***(1), 246-251. https://doi.org/10.48165/ajm.2026.9.01.50