



Patient-Reported Outcomes Following Surgical Management of Oral Cancer

Sara Mehri¹, Abbas Karimi^{2,3}, Masoume Farhangiyan³, Amir Jalal Abbasi^{2,3*} 

1. Students' Scientific Research Center, Tehran University of Medical Sciences, Tehran, Iran.

2. Department of Oral and Maxillofacial Surgery, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran.

3. Craniofacial Research Center, Tehran University of Medical Sciences, Tehran, Iran.

ARTICLE INFO

Article Type:
Original Article

Received: 12 September 2025

Revised: 4 November 2025

Accepted: 23 December 2025

*Corresponding author:

Amir Jalal Abbasi

Department of Oral and Maxillofacial Surgery,
School of Dentistry, Tehran University of Medical
Sciences, Tehran, Iran; Craniofacial Re-
search Center, Tehran University of Medical Sci-
ences, Tehran, Iran.

Tel: +98-21-84903747

Fax: +98-21-84903747

Email: aj-abbasi@tums.ac.ir

ABSTRACT

Introduction: Oral cavity cancers are a significant public health issue, particularly in South-Central Asia. While treatment efficacy has improved, the long-term impact on patients' quality of life (QoL) requires further investigation. This exploratory study aimed to assess the long-term QoL of patients with oral cancer following surgical treatment in a single-center Iranian cohort.

Materials and Methods: This retrospective, single-center cohort study involved 40 patients who underwent oral cancer surgery at Shariati Hospital, Tehran, between 2013 and 2023. Data were collected via structured telephone interviews using the validated Persian version of the University of Washington Quality of Life questionnaire (UW-QOL v4.0). Descriptive statistics were prioritized, with exploratory analyses to examine potential associations with demographic/clinical variables.

Results: The mean age was 55.2 years (± 10.8), and 60% were female. The buccal mucosa (52.5%) and tongue (30%) were the most common primary sites, with most patients (75%) diagnosed at advanced stages (III/IV). Pain was the most severely affected domain (mean score: 59.4), reported as a "significant problem" by 55% (22/40) of patients. Appearance, anxiety, and mood were also notably impaired. Shoulder function and saliva production were the best-preserved domains. Exploratory statistical analyses did not reveal significant associations between QoL scores and variables such as gender, disease stage, or age, though the study was underpowered for such comparisons (see Supplementary Tables S1–S6).

Conclusion: In this exploratory cohort, patients reported considerable long-term detriment in QoL after oral cancer surgery, particularly regarding pain and psychosocial domains. The findings, while limited by sample size, underscore the necessity for comprehensive, multidisciplinary survivorship care focused on pain management, psychological support, and functional rehabilitation. Larger, multi-center studies are needed to identify reliable predictors of QoL in this population.

Keywords: Oral cancer; Quality of life; Uw-qol questionnaire; Surgery; Post-treatment care; Survivorship.

Please cite this Article as:

Mehri S, Karimi A, Abbasi AJ, Farhangiyan M, Bahrami N. Patient-Reported Outcomes Following Surgical Management of Oral Cancer. J Craniofac Res 2026; 13(1): 52-61. DOI: [10.18502/jcr.v13i1.21476](https://doi.org/10.18502/jcr.v13i1.21476)



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Introduction

Oral cavity cancers, which include cancers of the lips, tongue, buccal mucosa, floor of the mouth, palate, and gums, pose a serious public health challenge worldwide. They account for over 377,000 new cases and about 177,000 deaths each year, with a higher incidence in South-Central Asia, including Iran. The age-standardized incidence rate is exceptionally high in low- and middle-income countries, often due to the everyday use of carcinogens like tobacco, alcohol, and areca nut [1–4]. In Iran, regional differences in risk factors, such as the use of traditional smokeless tobacco products like “Nas,” contribute to a unique epidemiological profile [5,6]. The management of oral cancer is multimodal and aggressive. While surgery, often combined with radiotherapy and/or chemotherapy, aims to improve survival, it can result in significant morbidity, including disfigurement, and impairments in swallowing, speech, and chewing [7,8].

Radiotherapy can cause xerostomia, tissue fibrosis, and osteoradionecrosis [9,10]. Consequently, health-related quality of life (HRQoL) has become a critical patient-reported outcome alongside traditional survival metrics [11,12]. The University of Washington Quality of Life questionnaire (UW-QOL) is a validated tool designed specifically to capture the multidimensional challenges faced by head and neck cancer patients [13,14]. Data on the long-term QoL of oral cancer survivors in Iran are limited. Therefore, this exploratory study aimed to describe the long-term QoL in a cohort of Iranian patients treated surgically for oral cancer using the UW-QOL instrument. A secondary, exploratory aim was to investigate potential associations with demographic and clinical factors.

Materials and Methods

Study Design and Setting

This was a retrospective, single-center, historical cohort study conducted at the Department of Maxillofacial Surgery, Shariati Hospital, a tertiary referral center in Tehran, Iran.

Participants and Sampling

The hospital's surgical registry was reviewed to identify all patients who underwent surgical resection for histologically confirmed oral cavity cancer between March 2013 and March 2023. The initial search yielded 51 eligible patients. Inclusion criteria were: **1)** confirmed oral cavity malignancy, **2)** surgical treatment at the study center, and **3)** willingness to provide informed

consent. Exclusion criteria were: **1)** being deceased or emigrated ($n = 6$, 11.8%), **2)** unable to communicate due to severe illness or cognitive impairment ($n = 2$, 3.9%), and **3)** refusal to participate ($n = 3$, 5.9%). A final cohort of 40 patients (78.4%) was established for assessment (Figure 1).

Data Collection

Data were collected via structured telephone interviews after obtaining verbal informed consent. This procedure, where a detailed information sheet was read to the participant and consent was documented, was approved by the Ethics Committee. The questionnaire comprised two parts:

- 1. Socio-demographic and Clinical Proforma:** Captured age, gender, education, marital status, tumor site, pathological TNM stage at diagnosis, and history of tobacco use.
- 2. QoL Assessment:** The Persian-validated version of the University of Washington Quality of Life questionnaire, version 4.0 (UW-QOL v4.0) was used [15]. Telephone administration was deemed appropriate and has been employed in previous studies. It assesses 12 domains: pain, appearance, activity, recreation, swallowing, chewing, speech, shoulder function, taste, saliva, mood, and anxiety. Domain scores are scaled from 0 (worst) to 100 (best).

Statistical Analysis

Data were analyzed using SPSS version 26. Descriptive statistics (mean, standard deviation, frequency) were used to summarize participant characteristics and QoL domain scores. Given the exploratory nature and small sample size, inferential statistics were used cautiously. Independent Samples t-tests were used to explore differences in mean domain scores by gender and disease stage grouping (Early: I/II vs. Advanced: III/IV). One-way ANOVA was used to explore differences across age groups, tumor sites, and education levels. Before parametric testing, assumptions of normality and homogeneity of variance were assessed using Shapiro-Wilk tests and Levene's tests, respectively. Data were approximately normally distributed, and Levene's tests were non-significant for the majority of domains, supporting the use of parametric tests for this exploratory analysis. As a sensitivity check, corresponding non-parametric tests (Mann-Whitney U, Kruskal-Wallis) were also conducted; their results were congruent with the parametric tests (i.e., no significant associations). A p -value < 0.05 was considered statisti-

cally significant, but the low statistical power for these comparisons is explicitly acknowledged as a limitation. Detailed results of all inferential tests are presented in the Supplementary Material (Tables S1–S6).

Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee of Tehran University of Medical Sciences (IR.TUMS.AMIRA.AM.REC.1403.042). Hospital administration permission was secured, and participant confidentiality was maintained throughout.

Results

Participant Characteristics

The demographic and clinical characteristics of the 40 participants are summarized in Table 1. The cohort had a mean age of 55.2 years (± 10.8) with a female predominance (60%, $n = 24$). Most participants were married (70%) and had a diploma or lower education level (62.5%). Smokeless tobacco use was reported by 65% ($n = 26$). The most common primary tumor site was the buccal mucosa (52.5%, $n = 21$), followed by the tongue (30%, $n = 12$). The majority (75%, $n = 30$) presented with advanced-stage disease (Stage III or IV). Information on the receipt of adjuvant radiotherapy was not systematically recorded and could not be analyzed.

Quality of Life Domain Scores

The profile of long-term QoL is presented in Figure 2 (bar chart of domain mean scores with error bars representing standard deviation). The domain with the lowest mean score was pain (59.4 ± 31.2), indicating the most significant long-term impairment. This was followed by the domains of appearance (65.8 ± 27.7), anxiety (63.9 ± 29.5), and mood (64.8 ± 28.4). In contrast, shoulder function (96.7 ± 12.5) and saliva production (83.6 ± 28.9) were the best-preserved domains. When asked to identify areas constituting a “significant problem,” pain was most frequently cited (55%, 22/40), followed by appearance (33%, 13/40) and anxiety (25%, 10/40). Regarding global QoL compared to the month before surgery, 72.5% ($n = 29$) felt “a little worse,” and 10% ($n = 4$) felt “much worse.”

Exploratory Analysis of Associations

Exploratory comparisons of mean UW-QOL domain scores by gender and disease stage are summarized in condensed form below, with full statistical details provided in Supplementary Tables S1 and S2. No statistically significant differences were found for any domain

when comparing males vs. females or early-stage (I/II) vs. advanced-stage (III/IV) disease (all $p > 0.05$). Similarly, one-way ANOVA tests revealed no significant differences in domain scores across categories of age (Supplementary Table S3), marital status (Supplementary Table S4), tumor site (Supplementary Table S5), or education level (Supplementary Table S6) (all $p > 0.05$). The results of these exploratory analyses are summarized in Table 2, which includes a note on any non-significant trends in mean scores observed in the supplementary data.

Discussion

This exploratory study provides a descriptive profile of the long-term QoL in a small, single-center cohort of Iranian oral cancer survivors treated primarily with surgery. The central finding is that patients experience a substantial and persistent decline in QoL years after treatment. Chronic pain emerged as the most profound issue, followed by significant concerns related to appearance, anxiety, and mood. This aligns with global literature highlighting the multifaceted burden of head and neck cancer survivorship [16,17]. The high scores in shoulder function and salivary domains are encouraging and may reflect the specific impact of surgery without adjuvant radiotherapy in many patients, as radiotherapy is a principal cause of xerostomia and tissue fibrosis affecting shoulder mobility [9,18].

However, this interpretation is limited because information on adjuvant radiotherapy was not systematically recorded in this cohort. A notable observation was the lack of statistically significant associations between QoL scores and all examined demographic and clinical variables, including gender, age, and disease stage (Supplementary Tables S1–S6). While some studies have reported such associations [19,20], it is crucial to interpret our null findings in the context of the study’s primary limitation: a small sample size with limited statistical power. A post-hoc power analysis indicated that for detecting a medium effect size ($d = 0.5$) in a two-group comparison with $n = 40$ and $\alpha = 0.05$, the statistical power was approximately 0.35, well below the conventional 0.80 threshold. The study was not adequately powered to detect anything but very large effect sizes. Therefore, the uniformity of poor QoL scores across subgroups should be viewed as a clinical observation warranting confirmation in larger studies, not as a definitive conclusion that these factors are irrelevant. The overwhelming impact of the disease and its radical treatment may obscure more subtle demographic effects in a small cohort.

Limitations

Several limitations must be acknowledged:

1. **Small Sample Size and Power:** The primary limitation constraining generalizability and the ability to detect statistically significant associations. The study was underpowered for the inferential analyses performed.
2. **Lack of Treatment Detail:** The absence of data on surgical extent, reconstruction type, and receipt of adjuvant therapy (chemoradiation) prevents analysis of how treatment intensity influences QoL outcomes.
3. **Single-Center, Retrospective Design:** Introduces potential selection bias and limits external validity.

4. **Attrition Bias:** Excluding deceased and severely ill patients likely results in an overestimation of QoL in the overall survivor population.

5. **Cross-Sectional Assessment:** Precludes causal inference about changes in QoL over time.

Strengths

The study benefits from using a validated, disease-specific QoL instrument (UW-QOL) and provides rare long-term follow-up data from an understudied regional context.

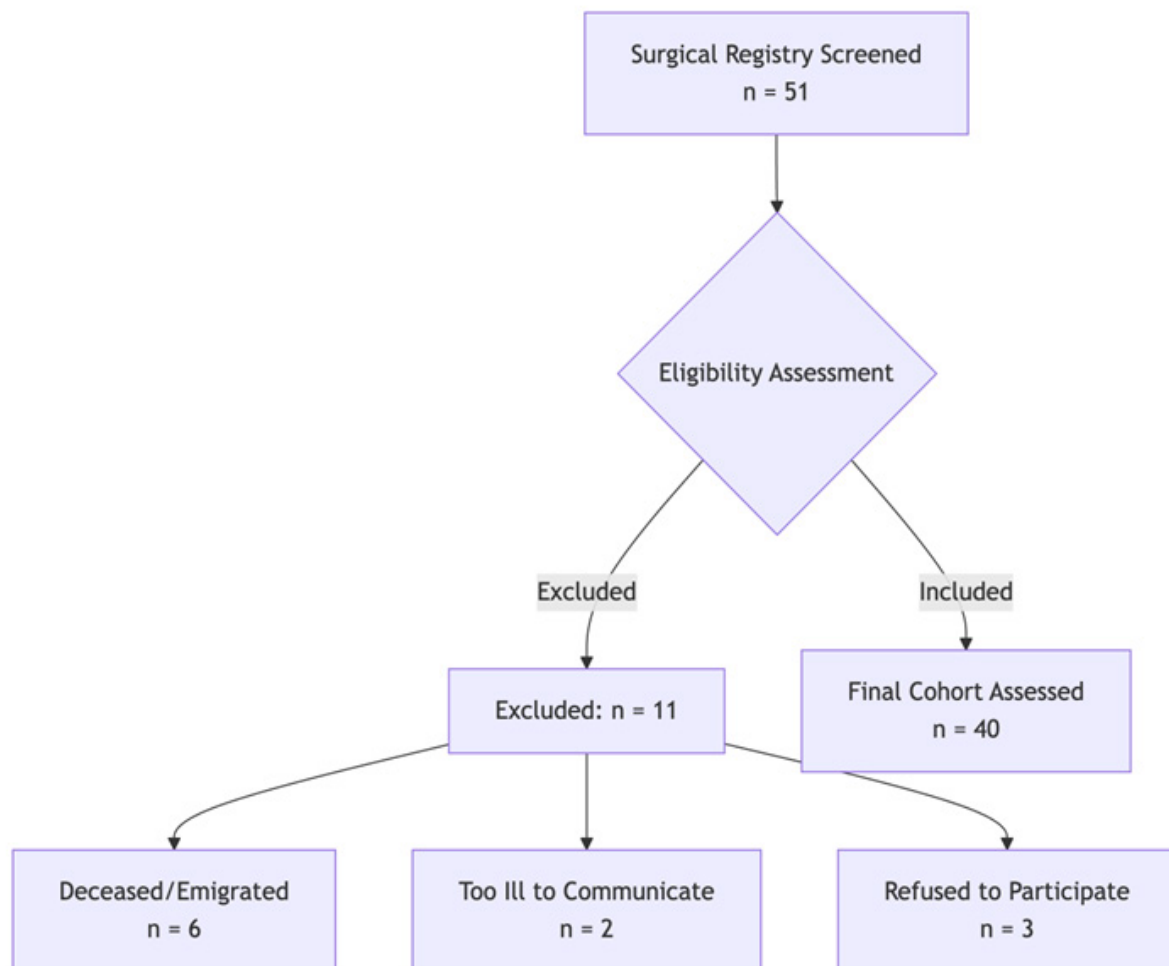


Figure 1. Patient flow diagram.

Table 1. Demographic and clinical characteristics of participants (n = 40).

Variables	n	Percentage (%)
<i>Age (years)</i>		
10-19	6	15.0
30-39	4	10.0
40-49	6	15.0
50-59	4	10.0
60-69	10	25.0
≥70	10	25.0
<i>Gender</i>		
Male	16	40.0
Female	24	60.0
Tongue	12	30.0
Floor of the mouth	3	7.5
Other	4	10.0
<i>Stage at Diagnosis</i>		
Stage I	3	7.5
Stage II	7	17.5
Stage III	18	45.0
Stage IV	12	30.0
Buccal Mucosa	21	52.5

Table 2. Summary of exploratory analyses for qol associations.

Variable Compared	Test Used	Key Finding	Implied Direction of Effect (Non-Significant Trend)
Gender	Independent t-test (12 domains)	No significant differences (all $p > 0.05$) See Supplementary Table S1.	No consistent trend
Disease Stage	Independent t-test (12 domains)	No significant differences (all $p > 0.05$) See Supplementary Table S2.	Scores were numerically lower in the Advanced Stage group across most domains (NS).
Age Group	One-way ANOVA (12 domains)	No significant differences (all $p > 0.05$) See Supplementary Table S3.	No consistent trend
Marital Status	Independent t-test (12 domains)	No significant differences (all $p > 0.05$) See Supplementary Table S4.	Scores were numerically higher in the Unmarried/Other group (NS).
Tumor Site	One-way ANOVA (12 domains)	No significant differences (all $p > 0.05$) See Supplementary Table S5.	No consistent trend
Education Level	One-way ANOVA (12 domains)	No significant differences (all $p > 0.05$) See Supplementary Table S6.	No consistent trend

Table S1. Independent samples t-test results comparing uw-qol domain scores by gender.

UW-QOL Domain	Male (n=16) Mean ± SD	Female (n=24) Mean ± SD	Mean Difference	t-value	p-value
Pain	61.88 ± 30.15	57.71 ± 32.25	4.17	0.402	0.690
Appearance	68.75 ± 26.34	63.75 ± 28.89	5.00	0.577	0.567
Activity	68.75 ± 25.62	65.83 ± 27.89	2.92	0.341	0.735
Recreation	70.00 ± 28.80	66.67 ± 29.81	3.33	0.359	0.722
Swallowing	77.08 ± 28.14	74.48 ± 29.89	2.60	0.277	0.783
Chewing	62.50 ± 31.20	58.33 ± 30.15	4.17	0.422	0.675
Speech	73.96 ± 27.80	71.53 ± 28.90	2.43	0.270	0.789
Shoulder Function	97.92 ± 8.37	95.83 ± 14.93	2.09	0.523	0.604
Taste	75.00 ± 28.80	72.92 ± 29.81	2.08	0.224	0.824
Saliva	85.42 ± 24.34	82.29 ± 31.25	3.13	0.341	0.735
Mood	66.67 ± 26.83	63.33 ± 28.90	3.34	0.382	0.705
Anxiety	65.63 ± 28.14	62.71 ± 30.15	2.92	0.314	0.755

*Corresponding non-parametric test (Mann-Whitney U): No significant differences were found for any domain. (all $p > 0.05$), confirming the t-test results.

Table S2. Independent samples t-test results comparing uw-qol domain scores by cancer stage (Early I & II vs. Advanced III & IV).

UW-QOL Domain	Early Stage (I & II) (n=10) Mean ± SD	Advanced Stage (III & IV) (n=30) Mean ± SD	Mean Difference	t-value	p-value
Pain	63.00 ± 29.48	58.20 ± 31.90	4.80	0.424	0.674
Appearance	70.00 ± 27.39	64.33 ± 28.34	5.67	0.558	0.580
Activity	72.00 ± 26.83	65.33 ± 27.20	6.67	0.647	0.505
Recreation	73.00 ± 28.48	66.33 ± 29.58	6.67	0.614	0.543
Swallowing	81.00 ± 26.83	73.67 ± 29.81	7.33	0.647	0.505
Chewing	65.00 ± 30.00	58.33 ± 30.60	6.67	0.594	0.556
Speech	77.00 ± 26.83	71.00 ± 28.90	6.00	0.594	0.556
Shoulder Function	100.00 ± 0.00	95.56 ± 14.94	4.44	1.000	0.324
Taste	78.00 ± 26.83	72.33 ± 30.15	5.67	0.514	0.610
Saliva	87.00 ± 23.67	82.33 ± 30.15	4.67	0.456	0.651
Mood	68.00 ± 26.83	63.67 ± 28.34	4.33	0.424	0.674
Anxiety	67.00 ± 28.46	62.67 ± 29.58	4.33	0.404	0.689

*Corresponding non-parametric test (Mann-Whitney U): No significant differences were found for any domain (all $p > 0.05$), confirming the t-test results.

Table S3. Results of one-way anova for qol domains by age group.

UW-QOL Domain	F-value (df)	p-value
Pain	0.382 (5, 34)	0.857
Appearance	0.294 (5, 34)	0.912
Activity	0.243 (5, 34)	0.939
Recreation	0.256 (5, 34)	0.933
Swallowing	0.317 (5, 34)	0.900

UW-QOL Domain	F-value (df)	p-value
Chewing	0.382 (5, 34)	0.857
Speech	0.352 (5, 34)	0.877
Shoulder Function	0.891 (5, 34)	0.496
Taste	0.352 (5, 34)	0.877
Saliva	0.301 (5, 34)	0.909
Mood	0.273 (5, 34)	0.925

*Corresponding non-parametric test (Kruskal-Wallis H): No significant differences were found for any domain (all p > 0.05), confirming the ANOVA results.

Table S4. Independent samples t-test results comparing uw-qol domain scores by marital status.

UW-QOL Domain	Married (n=28) Mean ± SD	Unmarried/Di- vorced/Widowed (n=12) Mean ± SD	Mean Difference	t-value	p-value
Pain	58.93 ± 30.85	60.42 ± 33.07	-1.49	-0.134	0.894
Appearance	64.29 ± 27.59	69.44 ± 29.87	-5.15	-0.523	0.604
Activity	65.48 ± 27.34	70.83 ± 27.39	-5.35	-0.567	0.574
Recreation	66.67 ± 29.58	72.22 ± 29.87	-5.55	-0.523	0.604
Swallowing	73.81 ± 29.52	79.17 ± 28.87	-5.36	-0.508	0.615
Chewing	58.93 ± 30.85	60.42 ± 30.60	-1.49	-0.134	0.894
Speech	71.43 ± 28.57	75.00 ± 29.15	-3.57	-0.359	0.722
Shoulder Function	95.24 ± 13.42	100.00 ± 0.00	-4.76	-1.296	0.203
Taste	72.62 ± 29.52	76.39 ± 29.87	-3.77	-0.359	0.722
Saliva	82.14 ± 29.71	87.50 ± 27.39	-5.36	-0.508	0.615
Mood	63.10 ± 28.57	68.75 ± 26.56	-5.65	-0.567	0.574
Anxiety	62.50 ± 29.52	67.19 ± 29.87	-4.69	-0.449	0.656

*Corresponding non-parametric test (Mann-Whitney U): No significant differences were found for any domain (all p > 0.05), confirming the t-test results.

Table S5. Results of one-way anova for qol domains by tumor site.

UW-QOL Domain	F-value (df)	p-value
Pain	0.103 (3, 36)	0.958
Appearance	0.010 (3, 36)	0.999
Activity	0.003 (3, 36)	1.000
Recreation	0.041 (3, 36)	0.989
Swallowing	0.128 (3, 36)	0.943
Chewing	0.103 (3, 36)	0.958
Speech	0.193 (3, 36)	0.901
Shoulder Function	1.189 (3, 36)	0.327
Taste	0.193 (3, 36)	0.901
Saliva	0.007 (3, 36)	0.999
Mood	0.032 (3, 36)	0.992
Anxiety	0.051 (3, 36)	0.985

*Corresponding non-parametric test (Kruskal-Wallis H): No significant differences were found for any domain (all p > 0.05), confirming the ANOVA results.

Table S6. Results of one-way anova for qol domains by education level.

UW-QOL Domain	F-value (df)	p-value
Pain	0.174 (2, 37)	0.841
Appearance	0.069 (2, 37)	0.933
Activity	0.025 (2, 37)	0.975
Recreation	0.065 (2, 37)	0.937
Swallowing	0.073 (2, 37)	0.930
Chewing	0.174 (2, 37)	0.841
Speech	0.067 (2, 37)	0.935
Shoulder Function	0.227 (2, 37)	0.798
Taste	0.067 (2, 37)	0.935
Saliva	0.034 (2, 37)	0.967
Mood	0.024 (2, 37)	0.976
Anxiety	0.011 (2, 37)	0.989

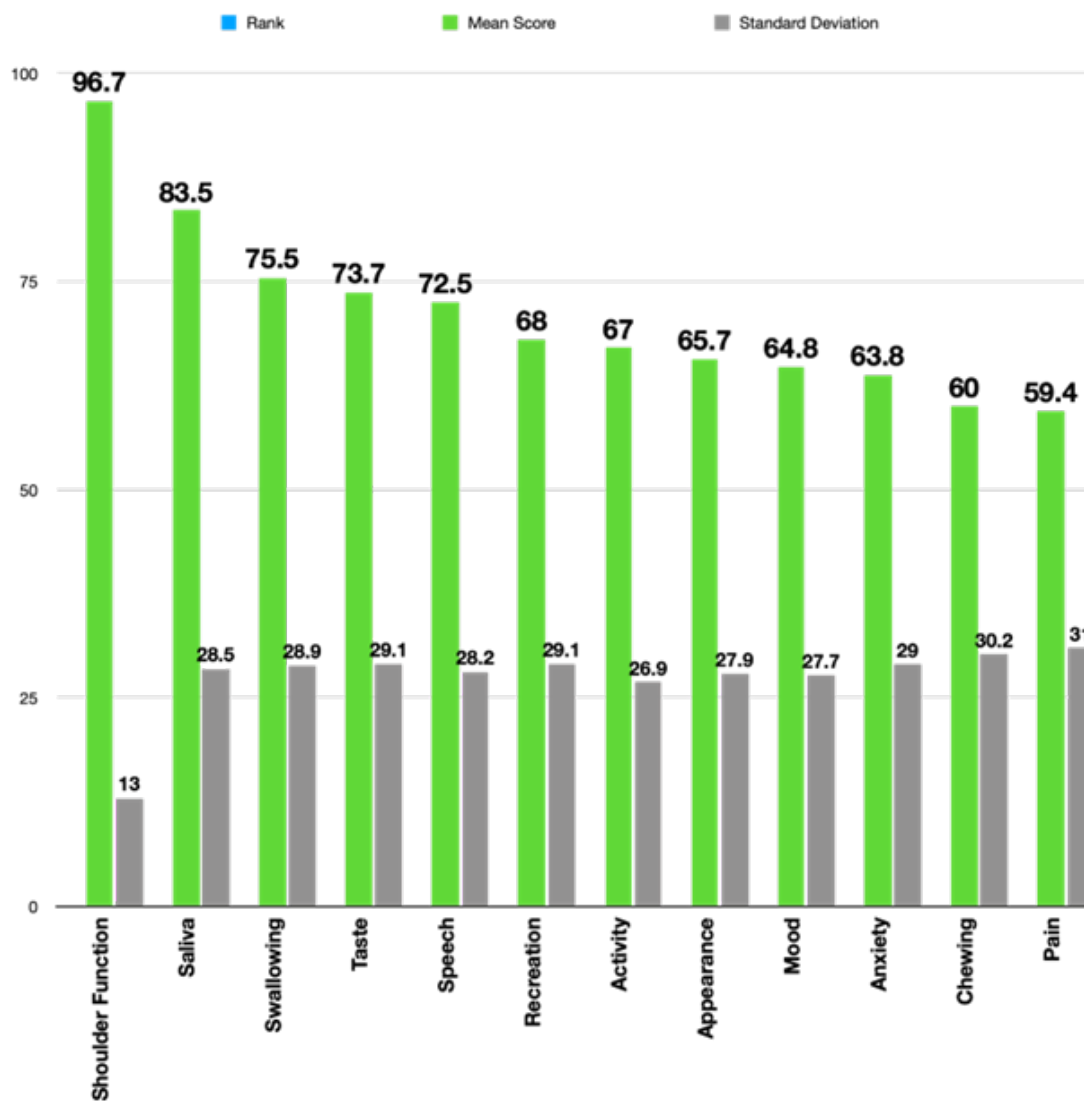


Figure 2. Mean UW-QOL domain scores with standard deviations.

Conclusion

In this exploratory cohort, patients undergoing surgery for oral cancer reported a significant long-term deterioration in QoL, with pain and psychosocial domains being most affected. These findings highlight an urgent need to integrate comprehensive survivorship programs—encompassing structured pain management, psychological support, and functional rehabilitation—into standard oncology care in our setting. The consistently low QoL scores across patient subgroups, while requiring validation in larger studies, suggest that such support should be offered broadly to all survivors. Future research must involve larger, prospective, multi-center studies with detailed treatment documentation to accurately identify predictors of poor QoL and inform the development of targeted interventions.

Acknowledgment

This research was supported by the Exceptional Talented Development Center and the Students' Scientific Research Center of Tehran University of Medical Sciences.

Conflict of Interest

There is no conflict of interest to declare.

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