Research Article

Patient-Reported Barriers To Routine Dental Care And Postoperative Maxillofacial Prosthetic Rehabilitation In Head And Neck Cancer Patients: A Cross-Sectional Study

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Abstract

Background: Survivors of head and neck cancer require sustained oral healthcare after cancer therapy; few cases may additionally need specialized maxillofacial prosthetic rehabilitation. **Objective:** To assess patient-reported barriers to routine dental care among post-treatment head and neck cancer patients and, among those requiring a maxillofacial prosthesis, to characterize barriers to postoperative prosthetic rehabilitation.
Methods: A cross-sectional survey was conducted among 194 post-treatment head and neck cancer patients. The routine dental-care questionnaire assessed education and counseling, follow-up, financial access, provider availability, transportation, travel, and persistent oral symptoms. Forty-eight patients (24.7%) required maxillofacial prosthetic rehabilitation and completed an additional 16-item prosthetic-access module scored from 1 (not a barrier) to 5 (very major barrier); scores of 4-5 were classified as major barriers. Proportions were reported with Wilson 95% confidence intervals. Factors associated with unmet dental-care need were evaluated using multivariable logistic regression.
Results: The cohort had a mean age of 59.8 ± 10.0 years, and 149 (76.8%) participants were male. Regular post-treatment dental follow-up was reported by 146 (75.3%), whereas 83 (42.8%) reported concern about dental-care costs and 69 (35.6%) reported an unmet dental-care need. Among the 48 patients requiring prosthetic rehabilitation, the most common major barriers were travelling distance (32; 66.7%), financial burden (31; 64.6%), and repeated appointments (29; 60.4%). Limited mouth opening was strongly associated with unmet dental-care need (adjusted odds ratio [aOR] 4.40, 95% CI 2.25-8.60; p<0.001). Cost concern (aOR 2.24, 95% CI 1.15-4.34; p=0.018) and difficulty finding an appropriate dentist (aOR 2.38, 95% CI 1.07-5.27; p=0.033) were also independently associated with unmet care.
Conclusion: Substantial barriers to oral healthcare persisted after head and neck cancer treatment. Patients requiring maxillofacial prosthetic rehabilitation faced an additional burden related to travel, cost, specialist availability, etc. These findings support integrated dental and maxillofacial prosthetic pathways within survivorship care.

Keywords: Head and neck neoplasms; Dental care utilization; Maxillofacial prosthesis; Prosthodontic rehabilitation; Healthcare access.

1. Introduction

Head and neck cancer and its treatment can produce persistent oral and maxillofacial morbidity long after completion of oncologic therapy. Radiotherapy may contribute to xerostomia, mucosal injury, dental disease, fibrosis, trismus, and osteoradionecrosis, creating a continuing need for preventive and restorative dental care [1,2].The oral side effects of head and neck radiation are clinically significant due to the potential for interaction among salivary dysfunction, changes in oral microbiota, tooth decay, periodontal breakdown, and impaired wound healing [3]. These conditions have an impact on nutrition, speech, oral hygiene, social functioning, and quality of life [4].

Dental problems are also frequently seen before the commencement of cancer therapy. The OraRad registry showed that a significant number of patients prior to radiotherapy were suffering from clinical problems related to dental diseases, thereby highlighting the need for comprehensive dental evaluation before and after oncology treatment [5]. Bone exposure and osteoradionecrosis are late issues of concern seen among irradiated individuals [6]. A systematic review of individuals undergoing cancer treatment also confirmed the range of dental diseases encountered in oncology treatment [7].

Post-treatment access to dental services is therefore an essential component of survivorship rather than an optional adjunct. Earlier work has shown that patients with head and neck cancer may fail to receive regular dental review even when such review is clinically indicated [8-10]. Patient education and the organization of oral healthcare after cancer treatment are also inconsistent across settings [11].

Patient-reported experiences can reveal barriers that are not apparent from clinical records. Survivors have reported unmet supportive-care needs after head and neck cancer, including dental and functional concerns [12]. Financial toxicity can persist after cancer treatment and may influence willingness or ability to pursue dental care [13]. Head and neck cancer survivors have also described specific needs that should be incorporated into survivorship planning [14,15]. Survivorship planning consequently requires coordination among oncology, dentistry, rehabilitation, and primary care [16,17].

The 2023 OraRad study by Threet et al. [1] offers a valuable tool to investigate post-treatment dentistry experiences. The study's 20-item survey covered beliefs regarding oral health and dental education, attitudes towards dental follow-ups and dentist perceptions, economic and transport barriers, problems finding a dentist, distances from clinics, and chronic oral symptoms. Nonetheless, the framework described above fails to define the extra path followed by patients who need maxillofacial prosthetic rehabilitation after the treatment.

Maxillofacial prosthodontics still plays a crucial part in multidisciplinary head and neck cancers treatment approach. According to the survey performed among National Cancer Institute-designated comprehensive cancer centers, cost-related issues still constitute the key barriers for prosthetic rehabilitation and its significance is clinically significant [18]. The latest reviews of prosthetic rehabilitation state that the maxillofacial prosthodontist should be engaged in treatment planning at early stages rather than right after ablative surgery [19].

Implications of successful rehabilitation are not limited to the healing of the defect only. There may be functional and cosmetic benefits for patients wearing prostheses along with increased confidence and improvement in their quality of life, although problems regarding retention, manipulation, longevity of materials, and maintenance still apply [20]. For maxillary defects, both the prosthesis and surgery are possible options that may provide quality of life; the choice depends on several factors [21].

The present study therefore evaluated patient-reported barriers across two related levels of survivorship care: routine dental care among all surveyed head and neck cancer patients and postoperative maxillofacial prosthetic rehabilitation among patients with acquired defects requiring prosthesis. The objectives were to describe routine dental-care utilization and barriers, quantify persistent oral and maxillofacial symptoms, characterize prosthesis-specific barriers among the 48 patients requiring rehabilitation, and identify factors independently associated with unmet routine dental-care need.

2. Materials and Methods

2.1 Study design and participants

A cross-sectional survey included 194 post-treatment patients with head and neck cancer. All participants completed the routine dental-care and symptom assessment, and the 48 patients who required postoperative maxillofacial prosthetic rehabilitation completed an additional prosthetic-access module. Participants were selected through convenient sampling from a tertiary care center from Southern part of India. Sample size was calculated based on the study reported by Threet EJ etal.[1], a sample of 190 individuals was sufficient to detect statistically significant difference of 10% with 95% confidence interval and 80% power. Assuming 5% non-response rate, final sample size was adjusted to 200. Out of 200 participants 194 individuals agreed to participate in this study.This study was reported in accordance with the principles of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement [22].The study protocol was approved by the Institutional Ethics

Committee[SRB/SDC/PhD/PHD-2324/23/TH-099] and written informed consent was obtained from all the participants.

2.2 Study variables

Participant characteristics recorded for analysis included age, sex, residence, educational level, primary tumor site, surgical treatment, radiotherapy, chemotherapy, time since cancer treatment and requirement for maxillofacial prosthetic rehabilitation. Of the 194 participants, 48 required a maxillofacial prosthesis and 146 did not.Patients were analyzed according to whether maxillofacial prosthetic rehabilitation was required. The prosthetic subgroup was characterized further by prosthesis type, whether the prescribed prosthesis had been received, time to first prosthetic consultation, time to definitive prosthesis, and patient-reported barriers encountered during the rehabilitation pathway.

2.3 Questionnaire domains

The routine dental-care component was based on the conceptual domains used by Threet et al. [1] in the OraRad survey. Variables assessed oncologist recommendation for dental follow-up, regular dental attendance after cancer treatment, information provided by the dentist, perceived dentist knowledge about head and neck cancer-related oral care, financial concern, cost-related avoidance of care, difficulty finding an appropriate dentist, travel distance, transportation or caregiver dependence, and unmet dental-care need during the preceding 12 months.The symptom domain included xerostomia, dysphagia, limited mouth opening, dental caries, temporomandibular or jaw-joint problems, difficulty keeping the mouth open during dentistry, sore mouth or mucosal discomfort, tooth pain, gum pain, and cancellation or delay of a dental visit because of symptoms. These domains reflect recognized long-term oral consequences of head and neck cancer treatment [2].

2.4 Additional maxillofacial prosthetic rehabilitation module

Patients requiring maxillofacial prosthetic rehabilitation completed an additional 16-item access module. The module was developed from clinically relevant stages of the prosthetic pathway and published concerns regarding specialist availability, cost, referral, timing, and coordination of maxillofacial prosthetic services [18]. The complete module is shown in Table 1. Each item was scored from 1 (not a barrier) to 5 (very major barrier). Scores of 4 or 5 were classified as major barriers for prevalence reporting. The first 15 items represented specific barrier domains and were summarized as a count of major barriers, while the sixteenth item captured global access difficulty. Because the module was study-specific, item-level results were emphasized and psychometric findings were interpreted cautiously.

Table 1. Additional patient-reported maxillofacial prosthetic rehabilitation module

Domain	Question focus
Specialist availability	Difficulty locating a dentist or maxillofacial prosthodontist able to provide the required prosthesis
Referral delay	Delay or difficulty obtaining referral to an appropriate prosthetic rehabilitation service
Information/counselling	Insufficient explanation of prosthesis need, type, timing, expectations, or care pathway
Waiting time	Long interval before first prosthetic consultation or initiation of fabrication
Care coordination	Difficulty coordinating surgeon, oncologist, restorative dentist, and prosthodontic team
Travel distance	Burden associated with distance to the specialist rehabilitation center
Transportation/caregiver dependence	Difficulty arranging transport or dependence on another person for attendance
Financial burden	Difficulty affording prosthesis fabrication, clinical procedures, or associated travel
Insurance/reimbursement	Inadequate reimbursement, insurance support, or financial assistance

Repeated appointments	Burden created by the number of visits required for fabrication and fitting
Work/time burden	Difficulty obtaining leave from work or meeting family and other responsibilities
Physical limitations	Pain, trismus, xerostomia, scarring, fatigue, or altered anatomy making procedures difficult
Treatment-related delay	Delay because of wound healing, radiotherapy, chemotherapy, or other medical treatment
Fabrication procedures	Difficulty tolerating impressions, scanning, jaw records, try-in, or fitting procedures
Maintenance/repair access	Difficulty obtaining adjustment, repair, relining, replacement, or follow-up maintenance
Overall access difficulty	Global assessment of difficulty obtaining the required maxillofacial prosthetic rehabilitation
Response scale for every item: 1 = not a barrier, 2 = minor barrier, 3 = moderate barrier, 4 = major barrier, 5 = very major barrier. Scores of 4 or 5 were classified as a major barrier. The module was study-specific and item-level reporting was prioritized pending formal psychometric validation.	

2.5 Outcomes

The primary routine-care outcome was unmet dental-care need, defined as having delayed or foregone a needed dental visit during the previous 12 months. Prosthetic outcomes were the prevalence of major barriers, the number of major barriers per patient, receipt of the prescribed prosthesis, time to first prosthetic consultation, and time to definitive prosthesis among patients who received one.

2.6 Statistical analysis

Statistical analyses were performed using SPSS Statistics for Windows, Version 29.0 (IBM Corp., Armonk, NY, USA). Categorical variables were summarized using counts and percentages. Continuous variables were summarized as mean ± standard deviation when approximately symmetric and as median with interquartile range when skewed. Wilson 95% confidence intervals were calculated for key proportions. Participants who did and did not require maxillofacial prosthetic rehabilitation were compared using the chi-square test for categorical variables, Fisher exact test when expected cell counts were small, Welch independent-samples t test for age, and Mann-Whitney U test for time since cancer treatment.Internal consistency across the 15 specific prosthetic barrier items was assessed using Cronbach alpha. The coefficient was used as a measure of internal consistency only and was not considered evidence of content, construct, or criterion validity of the study-specific module.Multivariable logistic regression was used to examine factors associated with unmet routine dental-care need. Five prespecified predictors were entered simultaneously: concern about cost, difficulty finding an appropriate dentist, travel more than 30 km, limited mouth opening, and lack of post-cancer oral-health information from the dentist. Results were expressed as adjusted odds ratios with 95% confidence intervals. Collinearity was examined using variance inflation factors. Model discrimination was summarized using the area under the receiver operating characteristic curve, and overall prediction error using the Brier score. Calibration was explored with a Hosmer-Lemeshow goodness-of-fit test. All tests were two-sided and $p<0.05$ was considered statistically significant. Structural absence occurred only for time to definitive prosthesis in participants who had not received prosthesis; no imputation was performed.

3. Results

3.1 Participant characteristics

The study included 194 participants with a mean age of 59.8 ± 10.0 years. There were 149 males (76.8%) and 45 females (23.2%). The median time since cancer treatment was 31.5 months (IQR 21.2-41.8).Forty-eight participants required maxillofacial prosthetic rehabilitation, corresponding to 24.7% of the cohort (95% CI 19.2-31.3%).Oral-cavity tumors were more frequent in the prosthetic subgroup than in participants who did not require a prosthesis (27/48, 56.3% versus 42/146, 28.8%; overall tumor-site comparison p=0.004). Combination of Surgery with chemotherapy and radiotherapy was also more common among participants requiring a prosthesis (41/48, 85.4%

versus 98/146, 67.1%; p=0.015). Age, sex, residence, education, radiotherapy exposure, chemotherapy exposure, and time since treatment did not differ statistically between groups (Table 2).

Table 2. Participant characteristics according to requirement for maxillofacial prosthetic rehabilitation

Characteristic	Total (N=194)	No prosthesis (n=146)	Prosthesis required (n=48)	P value
Age (years, mean ± SD)	59.8 ± 10.0	59.2 ± 9.7	61.7 ± 10.8	0.158 (Unpaired 't' test)
Gender Male Female Total	 149 (76.8) 45(23.2) 194(100)	 112 (76.7) 34(23.3)	 37 (77.1) 11(22.9)	 0.958 (Chi-square test)
Residence Urban Semi-urban Rural	 78 (40.2) 68 (35.1) 48 (24.7)	 57 (39.0) 48 (32.9) 41 (28.1)	 21 (43.8) 20 (41.7) 7 (14.6)	 0.623 (Chi-square test)
Education ≤ High school > High school <Graduation Graduation and above	 79 (40.7) 92(47.4) 25(12.9)	 58 (39.7) 73(49.3) 17(11)	 21 (43.8) 19(39.6) 8(16.6)	 0.082 (Chi-square test)
Primary tumor site Oral cavity Oropharynx Larynx/Hypopharynx Salivary gland Other	 69 (35.6) 54 (27.8) 22 (11.3) 22 (11.3) 27 (13.9)	 42 (28.8) 47 (32.2) 15 (10.3) 18 (12.3) 24 (16.4)	 27 (56.3) 7 (14.6) 7 (14.6) 4 (8.3) 3 (6.3)	 0.004 (Chi-square test)
Treatment modality Surgery + Radiotherapy+ Chemotherapy Surgery + Radiotherapy Chemotherapy alone Radiotherapy alone	 139 (71.6) 44 (22.7) 7 (3.6) 3(2.1)	 98 (67.2) 36 (25.8) 7(4.8) 3(2.2)	 41 (85.4) 8 (14.6) 0 0	 0.015 (Chi-square test)
Time since treatment, months, median (IQR)	31.5 (21.2-41.8)	32.0 (22.2-42.0)	27.0 (18.5-38.2)	0.132 (Unpaired 't' test)

3.2 Routine dental-care utilization and barriers

Post-treatment dental follow-up had been recommended by an oncologist for 173 participants (89.2%), while 146 (75.3%) had regular dental follow-up. Only 127 (65.5%) reported receiving post-cancer oral-health information from their dentist, and 129 (66.5%) perceived their dentist as knowledgeable about head and neck cancer-related oral care (Table 3).Financial and access barriers were prominent. Concern about the cost of dental care was reported by 83 participants (42.8%), and 44 (22.7%) had avoided or delayed care because of cost. Difficulty finding an appropriate dentist was reported by 38 (19.6%). Travel of more than 30 km for dental care was required by 61 (31.4%), while 26 (13.4%) reported a transportation or caregiver barrier. Overall, 69 participants (35.6%; 95% CI 29.2-42.5%) reported an unmet dental-care need during the preceding 12 months.

Table 3. Routine dental-care utilization and patient-reported access barriers in the cohort

Measure	n (%)	95% CI for %
Oncologist recommended dental follow-up	173 (89.2)	84.0-92.8
Regular post-treatment dental follow-up	146 (75.3)	68.7-80.8
Dentist provided post-cancer oral-health information	127 (65.5)	58.5-71.8
Dentist perceived as knowledgeable about HNC-related oral care	129 (66.5)	59.6-72.8
Concern about cost of dental care	83 (42.8)	36.0-49.8
Avoided/delayed dental care because of cost	44 (22.7)	17.4-29.9
Difficulty finding an appropriate dentist	38 (19.6)	14.6-25.7
Travel >30 km for dental care	61 (31.4)	25.3-38.3
Transportation/caregiver barrier	26 (13.4)	9.3-18.9
Unmet dental-care need in previous 12 months	69 (35.6)	29.2-42.5
Wilson 95% confidence intervals are shown for proportions.		

3.3 Persistent oral and maxillofacial symptoms

Xerostomia was the most frequent symptom, affecting 145 participants (74.7%). Limited mouth opening was present in 64 (33.0%), dental caries in 61 (31.4%), and dysphagia in 55 (28.4%). Difficulty keeping the mouth open during dental treatment affected 41 participants (21.1%). Twenty participants (10.3%) had cancelled or delayed a dental visit because of treatment-related symptoms (Table 4).

Table 4. Persistent oral and maxillofacial symptoms after head and neck cancer treatment

Symptom	n (%)	95% CI for %
Dry mouth/xerostomia	145 (74.7)	68.2-80.3
Problems swallowing/dysphagia	55 (28.4)	22.5-35.1
Limited mouth opening/trismus	64 (33.0)	26.8-39.9
Dental caries	61 (31.4)	25.3-38.3
Temporomandibular problems	44 (22.7)	17.4-29.1
Difficulty keeping mouth open during dentistry	41 (21.1)	16.0-27.4
Sore mouth/mucosal discomfort	48 (24.7)	19.2-31.3
Tooth pain	21 (10.8)	7.2-16.0
Gum pain	29 (14.9)	10.6-20.6
Cancelled/delayed dental visit because of symptoms	20 (10.3)	6.8-15.4

3.4 Maxillofacial prosthetic rehabilitation subgroup

Among the 48 participants requiring maxillofacial rehabilitation, obturators were the most common prosthesis type (26; 54.2%), followed by combined or other prostheses (12; 25.0%). A prescribed prosthesis had been received by 41 participants (85.4%), while 7 (14.6%) had not yet obtained one. The median time to the first prosthetic consultation was 5.3 weeks (IQR 4.3-7.7). Among recipients, the median time to definitive prosthesis was 20.6 weeks (IQR 14.2-28.1) (Table 5).The 15 specific prosthetic barrier items demonstrated high internal consistency (Cronbach alpha=0.95). Participants reported a median of 8.5 major barriers (IQR 3.0-12.0). Global access difficulty was rated as a major or very major barrier by 34 participants (70.8%).The most prevalent prosthesis-specific major barrier was travelling distance to the specialist center (32/48, 66.7%), followed by financial burden (31/48, 64.6%) and the need for repeated appointments (29/48, 60.4%). Specialist availability, waiting time, and care coordination were each major barriers for more than half of the subgroup. Physical limitations during prosthetic procedures were major barriers for 24 participants (50.0%). The complete distribution is presented in Table 6.

Table 5. Maxillofacial prosthetic rehabilitation pathway in the 48-patient subgroup

Measure	Value
Prosthesis required	48 (100.0)
Obturator	26 (54.2)

Mandibular resection prosthesis	5 (10.4)
Facial prosthesis	5 (10.4)
Combined/other prosthesis	12 (25.0)
Prescribed prosthesis received	41 (85.4)
Prescribed prosthesis not yet received	7 (14.6)
Time to first prosthetic consultation, weeks, median (IQR)	5.3 (4.3-7.7)
Time to definitive prosthesis among recipients, weeks, median (IQR)	20.6 (14.2-28.1)
Number of major prosthetic barriers, median (IQR)	8.5 (3.0-12.0)
Overall access difficulty rated major/very major	34 (70.8)
Time to definitive prosthesis is reported among the 41 participants who received a prosthesis. Major barrier = Likert score 4 or 5.	

Table 6. Major barriers to maxillofacial prosthetic rehabilitation in the subgroup (n=48)

Barrier domain	Major barrier n (%)	95% CI for %	Likert score (Mean ± SD)
Travel distance to specialist center	32 (66.7)	52.5-78.3	3.81 ± 1.28
Financial burden	31 (64.6)	50.4-76.6	3.94 ± 1.23
Repeated appointments	29 (60.4)	46.3-73.0	3.77 ± 1.15
Specialist availability	27 (56.2)	42.3-69.3	3.56 ± 1.44
Waiting time	27 (56.2)	42.3-69.3	3.50 ± 1.24
Care coordination	27 (56.2)	42.3-69.3	3.50 ± 1.30
Physical limitations during procedures	24 (50.0)	36.4-63.6	3.58 ± 1.25
Referral delay	24 (50.0)	36.4-63.6	3.29 ± 1.35
Work/time burden	23 (47.9)	34.5-61.7	3.25 ± 1.31
Transportation/caregiver dependence	22 (45.8)	32.6-59.7	3.12 ± 1.48
Insurance/reimbursement limitations	22 (45.8)	32.6-59.7	3.33 ± 1.48
Treatment-related delay	20 (41.7)	28.8-55.7	3.17 ± 1.34
Maintenance/repair access	20 (41.7)	28.8-55.7	3.19 ± 1.35
Information/counselling gaps	17 (35.4)	23.4-49.6	2.98 ± 1.19
Difficulty with fabrication procedures	16 (33.3)	21.7-47.5	2.77 ± 1.43
Major barrier = score 4 or 5 on a 1-5 scale. Internal consistency of the 15 specific barrier items: Cronbach alpha = 0.95.			

3.5 Factors associated with unmet dental-care need

In multivariable logistic regression, limited mouth opening showed the strongest independent association with unmet dental-care need (adjusted OR 4.40, 95% CI 2.25-8.60; p<0.001). Cost concern was independently associated with higher odds of unmet care (adjusted OR 2.24, 95% CI 1.15-4.34; p=0.018). Difficulty in finding an appropriate dental specialist was also significant (adjusted OR 2.38, 95% CI 1.07-5.27; p=0.033) (Table 7).Travel time more than 30 km and lack of post-cancer information from the dentist were not independently associated with unmet care after adjustment. The model likelihood-ratio test was significant (p<0.001), with a McFadden pseudo-R^2 of 0.129. Discrimination was moderate (AUC 0.733) and the Brier score was 0.191. The Hosmer-Lemeshow test did not indicate lack of fit (p=0.982). All variance inflation factors were below 1.60, indicating no important multicollinearity among the prespecified predictors.

Table 7. Multivariable logistic regression for unmet routine dental-care need (N=194)

Predictor	Adjusted OR	95% CI	P value
Cost concern	2.24	1.15-4.34	0.018
Difficulty finding dentist	2.38	1.07-5.27	0.033
Travel >30 km	0.67	0.32-1.38	0.275
Limited mouth opening	4.40	2.25-8.60	<0.001

Lack of post-cancer information	1.18	0.60-2.35	0.627
Outcome: delayed or foregone needed dental care during the previous 12 months. Model likelihood-ratio $p<0.001$; McFadden pseudo-$R^2=0.129$; AUC=0.733; Brier score=0.191; Hosmer-Lemeshow p=0.982; maximum VIF=1.60.			

4. Discussion

This cross-sectional study identified a substantial burden of patient-reported barriers to oral healthcare after treatment for head and neck cancer. Although three-quarters of participants reported regular post-treatment dental follow-up, more than one-third experienced an unmet dental-care need in the preceding year. Financial concerns, difficulty finding an appropriate dentist, and limited mouth opening were independently associated with unmet care. Among patients requiring maxillofacial prosthetic rehabilitation, the barrier profile was broader and was dominated by travel distance, financial burden, repeated appointments, specialist availability, waiting time, and coordination of care.

The routine dental-care findings can be considered alongside the OraRad survey, in which participants treated within a structured academic research network, reported relatively low frequencies of some access barriers [1]. Threet et al. reported that 7% of participants had difficulty finding a dentist and 7% did not receive dental care because of cost [1]. In the present study, 19.6% reported difficulty finding an appropriate dentist and 22.7% had avoided or delayed care because of cost. Differences in healthcare financing, referral pathways, availability of dental providers with oncology experience, and patient characteristics may contribute to this contrast, although direct comparisons between studies should be made cautiously.

The unmet need identified above appears to be in line with concerns about whether proper dental service access is available to such patients. Lawrence et al. [10] reported practical issues related to dental service access for this group of patients. This study adds to the problem mentioned above in terms of showing that although there is a referral to dental service follow-up, proper access to it does not always take place.

Financial issue was among the most common barriers of routine dental service use and was significantly associated with the unmet need for dental service in this study. Previous studies have reported the impact of financial issues on overall quality-of-life in relation to head and neck cancer [13]. Post-treatment oral health services may include preventive appointments, restorative dental treatments, management of radiographic diseases, prosthetic work and follow-ups. These expenses may put financial pressure on patients when they have to pay partly or fully for it themselves.

Provider availability was another important dimension. Difficulty finding an appropriate dentist was independently associated with unmet care. Patients who have received radiotherapy may require clinicians familiar with hyposalivation, rapidly progressive caries, altered tissue healing, osteoradionecrosis risk, trismus, and preventive strategies specific to cancer survivorship. Consequently, geographic availability of general dental services may not equate to availability of a provider who is comfortable managing post-treatment head and neck cancer patients. Variability in dental education and utilization after head and neck cancer has also been documented by Epstein and colleagues [11].

Limited mouth opening showed the strongest independent association with unmet dental-care need. This finding highlights how treatment-related morbidity can itself become an access barrier. Trismus may compromise oral examination, radiography, restorative instrumentation, impression procedures, oral hygiene, and the ability to tolerate prolonged dental appointments. The OraRad survey similarly identified persistent limitation in mouth opening and difficulty keeping the mouth open during dental procedures among post-radiotherapy patients [1]. In practice, access strategies for these patients may require trismus management, shorter or staged appointments, modified instrumentation, and referral to clinicians experienced in complex cancer rehabilitation.

The most common persistent symptom was xerostomia, experienced by almost three-quarters of the participants. Xerostomia is known to be a late effect of radiotherapy of the head and neck region, associated with mucositis, dysgeusia, dysphagia, dental caries, and poor oral function [2,3]. Therefore, the high prevalence noted in the current study underscores the necessity to provide not only dental access but also persistent symptoms, which increase the demand for preventive and corrective oral care in the process of survivorship care.

Dental caries affected almost one-third of the participants. Moore et al. noted that dental caries are a key complication following radiotherapy in patients with head and neck cancers [8], and the OraRad study showed that

teeth failure was also observed following radiotherapy [9]. In total, the data presented above show the clinical importance of the risk of oral decline due to the presence of high treatment needs and access barriers.

A unique finding of the current study is the assessment of barriers particular to maxillofacial prosthetic treatment. Of the 48 individuals requiring a prosthesis, travel distance, costs, multiple visits, specialist availability, wait time, and coordinating care were all important barriers to a significant number of patients. Similar to Rosen et al. [18], cost barriers have also been found to be important barriers to maxillofacial prosthetic services provided by National Cancer Institute designated comprehensive cancer centers. The present patient-reported findings complement that provider-level evidence by describing the difficulties experienced across the rehabilitation pathway.

Travel distance was the most common major prosthetic barrier. Maxillofacial prosthodontic services are generally concentrated in tertiary or specialist centers, so geographic access may be substantially more difficult than access to routine dentistry. Prosthetic rehabilitation can require multidisciplinary planning, impressions or digital records, jaw relations, try-in, delivery, adjustment, and long-term maintenance. The cumulative burden of repeated travel may be particularly important for patients with fatigue, dysphagia, altered speech, pain, restricted mouth opening, or caregiver dependence.

Repeated appointments were also reported frequently. Unlike a single restorative procedure, maxillofacial rehabilitation commonly requires iterative clinical and laboratory stages, and changes in the surgical site during healing may necessitate adjustment, relining, or replacement. Dings and colleagues showed that patients with facial prostheses must manage continuing issues related to use, care, retention, durability, and appearance [20]. Access to maxillofacial prosthetic care should therefore be viewed as an ongoing rehabilitation relationship rather than a single episode of prosthesis delivery.

Early multidisciplinary planning may help reduce several of these barriers. Vosselmanet al. [19] emphasized the importance of integrating the maxillofacial prosthodontist early in the head and neck cancer care pathway. Early involvement can assist in selecting between surgical reconstruction, prosthetic rehabilitation, or combined approaches; preserving strategically important structures; planning implant support where appropriate; and counselling patients about the expected sequence and duration of rehabilitation. It may also reduce referral delays and improve coordination between surgeons, oncologists, restorative dentists, and prosthodontists.

Seven of the 48 patients requiring a prosthesis (14.6%) had not yet received the prescribed prosthesis. This finding is clinically important because referral alone does not demonstrate successful rehabilitation. Completion can be influenced by cost, waiting time, wound healing, treatment sequencing, travel, medical status, physical tolerance, patient readiness, and availability of appropriately trained clinicians. Monitoring both time to first prosthetic consultation and time to definitive prosthesis may therefore provide a more meaningful assessment of service accessibility than referral status alone.

The prosthetic module also captured treatment-related physical limitations that can complicate rehabilitation. Pain, scarring, trismus, xerostomia, fatigue, and altered anatomy may make impressions, scanning, jaw records, try-in, or fitting procedures difficult. These factors interact with service design: patients with substantial physical limitations may benefit from shorter appointments, staged procedures, digital workflows where feasible, symptom control, and caregiver support.

Patient-reported measures are particularly valuable because the existence of a service does not establish that it is practically accessible or acceptable to patients. Ni Riordain and Wiriyakijja[15]highlighted the importance of patient-reported outcome and experience measures in oral medicine. Extending this approach to maxillofacial rehabilitation can identify barriers that may not be visible in surgical records, referral databases, or prosthodontic treatment notes.

The findings have direct implications for survivorship care. Head and neck cancer survivorship guidance emphasizes assessment of late effects and coordination across disciplines [16], while dental guidance around radiation therapy stresses structured preventive and treatment pathways [17]. A comprehensive survivorship program should identify dental and prosthetic needs early, provide patients with clear information, establish direct referral pathways to suitably trained providers, address financial and travel burdens where possible, and monitor whether recommended care is actually completed.

The additional prosthetic-access module demonstrated high internal consistency, but it should still be regarded as a study-specific instrument. Cronbach alpha does not establish content validity or dimensionality. Further work should include expert review, patient cognitive interviewing, test-retest reliability, factor-analytic assessment where sample size permits, convergent validity, and evaluation of responsiveness. Until formal validation is completed, item-level reporting remains clinically useful because individual barriers correspond to different potential service interventions.

Several limitations should be considered. The cross-sectional design precludes causal inference, and patient-reported responses may be affected by recall or reporting bias. The prosthetic subgroup was relatively small (n=48), which limits precision for subgroup analyses and supports a primarily descriptive interpretation of prosthesis-specific findings. The additional prosthetic module was study-specific and has not yet undergone full psychometric validation. In addition, barriers related to healthcare financing, specialist distribution, referral organization, and transport may vary across institutions and regions, which may limit generalizability of the observed prevalence estimates.

Despite these limitations, the study provides an integrated assessment of two clinically connected but distinct components of oral survivorship. Evaluating routine dental access in the full cohort and prosthetic-access barriers in the subgroup requiring rehabilitation makes it possible to identify both common and pathway-specific obstacles. This approach may support service redesign by linking patient-reported difficulties to targeted interventions in dental follow-up, referral coordination, financial support, travel assistance, and specialist rehabilitation capacity.

5. Conclusion

Among post-treatment head and neck cancer patients, barriers to oral healthcare remained common despite high rates of recommended dental follow-up. Unmet routine dental-care need was independently associated with financial concern, difficulty finding an appropriate dentist, and limited mouth opening. Patients requiring maxillofacial prosthetic rehabilitation faced additional barriers related to travel, cost, repeated visits, specialist availability, waiting time, and coordination of care. Integrating dental and maxillofacial prosthetic services into structured survivorship pathways, with particular attention to affordability, provider access, treatment-related functional limitations, and rehabilitation logistics, may improve continuity and completion of care.

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