Cureus
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Open Access Original Article

Association Between Post-radiotherapy Salivary Dysfunction and Patient-Reported Satisfaction With Removable Dental Prostheses Among Oral Cancer Survivors: A Cross-Sectional Observational Study

Review began 10/21/2026
Review ended 11/03/2026
Published 11/09/2026

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DOI: 10.7759/cureus.119384

Iqbal Kaur [1], Aarifa F. Afroz [2], Angel Angel [3], Madhura Bhave Joshi [4], Sameer Chauhan [5], Ajit Singh [2]

1. Department of Prosthodontics, Surendera Dental College and Research Institute, Sri Ganganagar, IND 2. Department of Radiation Oncology, Pandit Bhagwat Dayal Sharma Post Graduate Institute of Medical Sciences, Rohtak, IND 3. Department of Pedodontics and Preventive Dentistry, Desh Bhagat Dental College and Hospital, Mandi Gobindgarh, IND 4. Department of Oral Pathology and Microbiology, Tatyasaheb Kore Dental College and Research Centre, Pune, IND 5. Department of Prosthodontics, K. M. Shah Dental College and Hospital, Sumandeep Vidyapeeth (Deemed to be University), Vadodara, IND

Corresponding author: Angel Angel, angel20bansal@gmail.com

Abstract

Introduction: Radiotherapy for oral cancer may cause persistent salivary dysfunction, potentially compromising the comfort and functional performance of removable dental prostheses. This study aimed to evaluate the association between post-radiotherapy salivary dysfunction and patient-reported satisfaction with removable dental prostheses among oral cancer survivors, with particular emphasis on overall prosthetic satisfaction and specific functional domains, including comfort, retention, and stability, chewing, speech, and appearance.

Materials and methods: This hospital-based cross-sectional observational study included 100 clinically disease-free oral cancer survivors who had completed curative-intent radiotherapy and were using removable complete or partial dental prostheses. Subjective xerostomia was assessed using an 11-item questionnaire (Xerostomia Inventory score), while objective salivary function was evaluated using the unstimulated whole salivary flow rate. Overall prosthetic satisfaction was assessed using an 11-point numeric rating scale, with additional assessments of comfort, retention/stability, chewing ability, speech, and appearance. Associations between salivary measures and prosthetic satisfaction were evaluated using Spearman's rank correlation, with appropriate nonparametric and categorical tests used for group comparisons.

Results: Among the 100 participants, the mean age was 59.1 ± 8.7 years, with 61 (61.0%) males and 39 (39.0%) females. The mean unstimulated salivary flow rate was 0.31 ± 0.09 mL/min, and the mean Xerostomia Inventory score was 29.7 ± 5.6. The mean overall prosthetic satisfaction was 6.91 ± 1.27. Higher xerostomia was associated with lower salivary flow ($\rho = -0.762$, $p < 0.001$) and lower overall prosthetic satisfaction ($\rho = -0.680$, $p < 0.001$), whereas higher salivary flow was associated with greater satisfaction ($\rho = 0.690$, $p < 0.001$). All prosthetic satisfaction domains showed significant inverse correlations with xerostomia ($p < 0.001$).

Conclusion: Post-radiotherapy salivary dysfunction was strongly associated with reduced patient-reported satisfaction with the removable dental prostheses. Routine assessment of both subjective xerostomia and objective salivary function may help identify patients requiring individualized prosthetic planning and supportive management after oral cancer treatment.

Categories: Dentistry
Keywords: dental prosthesis, oral cancer, radiotherapy, salivary glands, xerostomia

Introduction

Oral cancer and its treatment can have profound and persistent effects on oral function and quality of life. Radiotherapy remains an important component of curative treatment for many patients with oral cavity malignancies, either alone or in combination with surgery and chemotherapy [1]. Although advances in radiotherapy techniques, including intensity-modulated radiotherapy (IMRT) and volumetric-modulated arc therapy (VMAT), have improved the ability to limit radiation exposure to surrounding tissues, salivary gland dysfunction remains an important late treatment-related complication [2,3]. Damage to the salivary gland tissue may result in reduced salivary secretion and persistent subjective oral dryness, commonly described as xerostomia [4,5]. These effects may continue long after the completion of cancer treatment and can substantially influence everyday oral functions.

How to cite this article
Kaur I, Afroz A F, Angel A, et al. (November 09, 2026) Association Between Post-radiotherapy Salivary Dysfunction and Patient-Reported Satisfaction With Removable Dental Prostheses Among Oral Cancer Survivors: A Cross-Sectional Observational Study. Cureus 18(11): e119384. DOI 10.7759/cureus.119384

Saliva plays an important role in lubrication, mucosal protection, swallowing, speech, taste, and maintenance of oral tissue health. Adequate salivary lubrication is particularly relevant to the function and tolerance of removable dental prostheses [6]. Reduced salivary flow may compromise denture retention and stability, increase friction between the prosthesis and oral mucosa, impair chewing and speech, and contribute to discomfort during prosthesis use [6,7]. Consequently, patients who have undergone radiotherapy may experience difficulty adapting to or satisfactorily using removable complete or partial dentures, even when the prosthesis is clinically acceptable. Objective salivary hypofunction and subjective xerostomia represent related but distinct dimensions of salivary dysfunction; therefore, the assessment of both measures may provide a more comprehensive understanding of their relationship with prosthetic satisfaction [8,9].

Patient-reported outcomes are increasingly important in evaluating oral rehabilitation because clinical assessments alone may not adequately capture a patient's perception of comfort, retention, chewing ability, speech, and appearance [9,10]. However, evidence specifically examining the relationship between post-radiotherapy salivary dysfunction and satisfaction with existing removable dental prostheses among oral cancer survivors is limited [11]. This study aimed to evaluate the association between post-radiotherapy salivary dysfunction and patient-reported satisfaction with removable dental prostheses among oral cancer survivors. The primary objective of this study was to assess the association between post-radiotherapy salivary dysfunction, evaluated using the Xerostomia Inventory and unstimulated whole salivary flow rate, and overall prosthetic satisfaction among oral cancer survivors using removable dental prostheses. The secondary objectives were to evaluate satisfaction across five prosthetic domains, namely comfort, retention/stability, chewing ability, speech, and appearance, and to examine the relationships between salivary dysfunction, radiotherapy-related characteristics, and prosthetic satisfaction.

Materials And Methods

Study design and setting

A hospital-based cross-sectional observational study was conducted in the Department of Radiation Oncology at Pandit Bhagwat Dayal Sharma Post Graduate Institute of Medical Sciences, Rohtak, India, between May 2024 and June 2025. The participants underwent a single standardized assessment during routine follow-up visits. The assessment included a review of radiotherapy-related clinical records, measurement of unstimulated whole salivary flow rate, evaluation of subjective xerostomia, and assessment of satisfaction with the removable prosthesis. The study protocol was reviewed and approved by the Institutional Ethics Committee (approval number: BREC/24/501, dated: 01-05-2024) before commencement. Written informed consent was obtained from all participants prior to enrollment.

Study participants

The eligibility criteria are listed in Table *1*.

Eligibility category	Criteria
Inclusion criteria	Age ≥18 years
	Histopathologically confirmed oral cavity squamous cell carcinoma
	Completed curative-intent radiotherapy at least 6 months before enrollment, with or without surgery and/or chemotherapy
	Clinically disease-free at the time of assessment
	Using a removable complete or partial dental prosthesis for at least 3 months
Exclusion criteria	Recurrent or metastatic disease
	Previous radiotherapy for another head-and-neck malignancy
	Known primary salivary gland disorder or Sjögren syndrome
	Current chemotherapy or other active anticancer treatment
	Severe systemic illness that could interfere with study assessment
	Inability to understand or complete the study questionnaires

TABLE 1: Eligibility criteria for study participants.

Demographic and clinical variables recorded for eligible participants included age, sex, primary tumor site, previous cancer treatment, medical history, xerogenic medication use, smoking history, type of removable prosthesis, and duration of prosthesis use.

Sample size estimation

The sample size was determined based on the primary objective of evaluating the correlation between salivary dysfunction and overall prosthetic satisfaction. Assuming a moderate correlation coefficient of $r = 0.30$, a two-sided significance level of $\alpha = 0.05$, and 80% statistical power, the minimum required sample size was calculated to be approximately 85. An additional 15% was considered to compensate for incomplete questionnaires, inadequate saliva samples, missing radiotherapy records, and other potentially unusable data. Accordingly, the final recruitment target was 100 participants in this study. The calculation was based on a two-tailed correlation analysis using G*Power version 3.1.9.7 (Heinrich Heine University, Düsseldorf, Germany).

A total of 262 potential participants were screened for eligibility. Of these, 162 were excluded because they did not meet the predefined inclusion criteria or fulfilled one or more exclusion criteria. The remaining 100 eligible participants were recruited and included in the final analysis. All 100 participants completed the salivary assessments and prosthetic satisfaction evaluation, and no participants were excluded from the final analysis due to incomplete data.

Radiotherapy assessment

Radiotherapy-related information was obtained directly from oncology treatment records and treatment summaries rather than relying on patient recall. The recorded variables included the radiotherapy technique, total prescribed radiation dose in Gy, number of fractions, dose per fraction, date of completion, and time elapsed since completion of radiotherapy. Information regarding concurrent or adjuvant chemotherapy and previous oncologic surgery was also documented. Radiotherapy technique was categorized according to the treatment received, including three-dimensional conformal radiotherapy and intensity-modulated radiotherapy/VMAT. Total radiation dose and time since completion of radiotherapy were retained as continuous variables for subsequent descriptive and exploratory analyses.

Assessment of salivary dysfunction

Salivary assessments, including unstimulated whole salivary flow rate measurement and administration of the 11-item Xerostomia Inventory, were performed by Aarifa F. Afroz using standardized assessment procedures. Patient-reported satisfaction with removable dental prostheses was assessed by a prosthodontist with more than five years of clinical experience in removable prosthodontics. Standardized instructions and consistent assessment protocols were followed during data collection to ensure uniformity in the administration of assessments. Objective salivary gland function was assessed by measuring the unstimulated whole salivary flow rate using a standardized passive drooling method. All participants had completed radiotherapy at least six months before enrollment. Salivary assessments were performed during a single follow-up visit, and the interval between radiotherapy completion and saliva collection was recorded as the elapsed time since the last radiotherapy session; however, this interval was not standardized across participants.

Participants were instructed to refrain from eating, consuming beverages other than water, smoking, chewing gum, and performing oral hygiene procedures for at least 60 minutes before saliva collection. After a brief resting period, participants were seated upright with minimal speech or orofacial movement. Saliva was allowed to accumulate naturally in the floor of the mouth and was subsequently expectorated or passively drooled into a pre-weighed or graduated sterile collection container over a standardized five-minute collection period. Participants were instructed to avoid swallowing whenever possible. The total volume of saliva collected was recorded, and the unstimulated whole salivary flow rate was calculated in mL/min by dividing the collected volume by the five-minute collection period [8]. Lower flow rates were interpreted as indicating greater objective salivary hypofunction.

For the objective classification of salivary function, an unstimulated whole salivary flow rate of $\leqslant 0.1$ mL/min was considered indicative of hyposalivation. Participants with flow rates above this threshold were classified as not meeting the objective criterion for hyposalivation. Subjective xerostomia was assessed independently using the 11-item Xerostomia Inventory, with higher scores indicating greater perceived oral dryness. Thus, subjective xerostomia and objectively measured salivary hypofunction were considered distinct but complementary parameters.

Subjective xerostomia was assessed using the 11-item Xerostomia Inventory (XI) [12]. The questionnaire evaluates the frequency of dry-mouth symptoms using 11 items, each rated on a five-point Likert scale: 1 (never), 2 (hardly ever), 3 (occasionally), 4 (fairly often), and 5 (very often). Item scores were summed to obtain a total score ranging from 11 to 55, with higher scores indicating greater severity of subjective xerostomia. Participants rated the frequency of xerostomia-related symptoms according to the response categories specified by the questionnaire. The XI score was analyzed primarily as a continuous variable to

preserve the information and avoid arbitrary categorization. Objective salivary hypofunction and subjective xerostomia are considered complementary but distinct measures of post-RT salivary dysfunction.

Assessment of prosthetic satisfaction

Patient-reported satisfaction with the existing removable dental prosthesis was assessed after completion of the salivary evaluation. Overall prosthetic satisfaction, defined a priori as the primary patient-reported outcome, was recorded using an 11-point numeric rating scale (NRS) ranging from 0 to 10, where 0 indicated complete dissatisfaction and 10 indicated complete satisfaction. Participants also independently rated five clinically relevant prosthetic domains using the same 0-10 scale: (1) comfort, referring to perceived comfort during prosthesis use; (2) retention/stability, reflecting the patient's perception of how securely the prosthesis remained in position during routine activities; (3) chewing ability, representing perceived masticatory function while wearing the prosthesis; (4) speech, reflecting perceived ease and clarity of speech with the prosthesis; and (5) appearance, representing satisfaction with the esthetic outcome. Higher scores indicated greater satisfaction [10,13,14]. The type of prosthesis, categorized as a removable partial denture or complete denture, duration of prosthesis use, and relevant clinical characteristics were recorded to facilitate the interpretation of patient-reported outcomes.

Validity and reliability of the satisfaction assessment

An 11-point NRS was used as a standardized measure of overall patient satisfaction. Additional domain-specific items addressing comfort, retention/stability, chewing ability, speech, and appearance were selected based on domains commonly assessed in validated removable prosthesis satisfaction instruments [14]. Each domain was rated independently by the participant using the same response scale and standardized instructions to ensure consistency in the administration and recording of responses. This study did not undertake a separate formal psychometric validation of the NRS-based assessment. However, the inclusion of multiple clinically relevant prosthetic domains provided a broader assessment of patient-perceived prosthetic satisfaction and facilitated the interpretation of functional and esthetic outcomes.

Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 25 (Released 2017; IBM Corp., Armonk, New York). Continuous variables were summarized as mean ± standard deviation (SD) when approximately normally distributed and as median with interquartile range (IQR) when skewed. Categorical variables were summarized as frequencies and percentages. Normality was assessed using the Shapiro-Wilk test. The primary analysis evaluated the association between the Xerostomia Inventory (XI) score and overall prosthetic satisfaction using Spearman’s rank correlation coefficient (ρ). The association between unstimulated whole salivary flow rate and overall prosthetic satisfaction was also assessed using Spearman’s rank correlation. For exploratory group comparisons, participants were categorized into lower- and higher-xerostomia groups according to the median XI score. Continuous variables were compared between groups using the Mann-Whitney U test and independent t-test, while categorical variables were compared using the chi-square test or Fisher’s exact test, as appropriate. All statistical tests were two-sided, and $p < 0.05$ was considered statistically significant.

Results

A total of 100 oral cancer survivors rehabilitated with removable dental prostheses were included in the analysis. The mean age of the participants was 59.1 ± 8.7 years, and 61 (61.0%) were males. The most frequent primary tumor site was the buccal mucosa, followed by the tongue. Previous surgical treatment had been performed in 73 (73.0%) participants, while 52 (52.0%) had received chemotherapy. IMRT/VMAT was the predominant radiotherapy technique, with a mean total radiotherapy dose of 62.1 ± 5.4 Gy. Removable partial dentures were used by 59 (59.0%) participants and complete dentures by 41 (41.0%) (Table *2*).

Characteristic		Overall cohort (N = 100)
Age, years	Mean ± SD	59.1 ± 8.7
Sex, n (%)	Male	61 (61.0)
	Female	39 (39.0)
Primary tumor site, n (%)	Buccal mucosa	31 (31.0)
	Tongue	19 (19.0)
	Lower alveolus	19 (19.0)
	Floor of mouth	11 (11.0)
	Other oral sites	20 (20.0)
Previous surgical treatment, n (%)	Yes	73 (73.0)
	No	27 (27.0)
Previous chemotherapy, n (%)	Yes	52 (52.0)
	No	48 (48.0)
Radiotherapy technique, n (%)	IMRT/VMAT	75 (75.0)
	3D-conformal radiotherapy	25 (25.0)
Total radiotherapy dose, Gy	Mean ± SD	62.1 ± 5.4
Time since completion of radiotherapy, months	Median (IQR)	27.4 (19.2–36.1)
Type of removable prosthesis, n (%)	Removable partial denture	59 (59.0)
	Complete denture	41 (41.0)
Duration of prosthesis use, months	Median (IQR)	22.0 (16.1–33.7)

TABLE 2: Demographic and clinical characteristics of the study participants (N = 100).

Data are presented as mean ± standard deviation (SD), median (interquartile range (IQR)), or number (percentage), as appropriate.

IMRT: intensity-modulated radiotherapy; VMAT: volumetric-modulated arc therapy; and RT: radiotherapy.

The mean Xerostomia Inventory score was 29.7 ± 5.6, while the mean unstimulated whole salivary flow rate was 0.31 ± 0.09 mL/min. The mean overall prosthetic satisfaction was 6.91 ± 1.27 on a 0-10 scale. Satisfaction scores for comfort, retention/stability, chewing ability, speech, and appearance were broadly comparable, ranging from 6.80 ± 1.48 to 6.89 ± 1.39 (Table 3).

Outcome measure	Values, mean ± SD (N = 100)
Xerostomia Inventory score	29.7 ± 5.6
Unstimulated whole salivary flow rate, mL/min	0.31 ± 0.09
Overall prosthetic satisfaction	6.91 ± 1.27
Comfort	6.86 ± 1.38
Retention/stability	6.88 ± 1.55
Chewing ability	6.80 ± 1.48
Speech	6.89 ± 1.39
Appearance	6.89 ± 1.38

TABLE 3: Descriptive statistics of xerostomia, salivary flow, and prosthetic satisfaction.

Data are presented as mean ± standard deviation (SD). Salivary dysfunction was assessed using the Xerostomia Inventory (XI) and unstimulated whole salivary flow rate. Prosthetic satisfaction was assessed using an 11-point numeric rating scale ranging from 0 to 10, with higher scores indicating greater satisfaction. XI scores range from 11 to 55, with higher scores indicating greater xerostomia.

Participants were divided into lower- and higher-xerostomia groups based on the median Xerostomia Inventory score of 29, with 50 (50.0%) participants in each group. The higher-xerostomia group had a significantly greater median radiotherapy dose and longer time since radiotherapy than the lower-xerostomia group (both $p \leq 0.001$). Unstimulated salivary flow was significantly lower among participants with higher xerostomia (0.25 ± 0.07 vs. 0.37 ± 0.07 mL/min; $p < 0.001$). Importantly, overall prosthetic satisfaction was significantly lower in the higher-xerostomia group (6.15 ± 1.15 vs. 7.67 ± 0.94; $p < 0.001$). All individual satisfaction domains, including comfort, retention/stability, chewing ability, speech, and appearance, were also significantly lower in this group (all $p < 0.001$). No significant differences were observed between the groups for age, sex, previous surgery, previous chemotherapy, radiotherapy technique, or type of removable prosthesis (Table *4*).

Outcome	Lower xerostomia (n = 50)	Higher xerostomia (n = 50)	Test value	p-value	Effect size
Age, years, median (IQR)	60.4 (53.4–65.1)	58.8 (53.3–66.8)	U = 1332.0	0.574	rrb = 0.066
Radiotherapy dose, Gy, median (IQR)	60.2 (57.1–64.0)	64.8 (59.7–67.9)	U = 765.0	0.001*	rrb = 0.388
Time since radiotherapy, months, median (IQR)	22.9 (16.8–27.6)	32.9 (26.6–40.1)	U = 672.5	< 0.001*	rrb = 0.462
Unstimulated salivary flow, mL/min. mean ± SD	0.37 ± 0.07	0.25 ± 0.07	t = 7.85	< 0.001*	d = 1.57
Overall prosthetic satisfaction, mean ± SD	7.67 ± 0.94	6.15 ± 1.15	t = 7.25	< 0.001*	d = 1.45
Comfort, mean ± SD	7.56 ± 1.00	6.17 ± 1.36	t = 5.82	< 0.001*	d = 1.16
Retention/stability, mean ± SD	7.75 ± 1.28	6.01 ± 1.48	t = 6.33	< 0.001*	d = 1.27
Chewing ability, mean ± SD	7.59 ± 1.17	6.01 ± 1.27	t = 6.45	< 0.001*	d = 1.29
Speech, mean ± SD	7.73 ± 1.06	6.05 ± 1.24	t = 7.19	< 0.001*	d = 1.44
Appearance, mean ± SD	7.64 ± 0.99	6.13 ± 1.35	t = 6.34	< 0.001*	d = 1.27
Male sex, n (%)	31 (62.0)	30 (60.0)	χ^2 = 0.040	0.842	V = 0.020
Previous surgery, n (%)	35 (70.0)	38 (76.0)	χ^2 = 0.203	0.652	V = 0.045
Previous chemotherapy, n (%)	26 (52.0)	26 (52.0)	χ^2 = 0.000	1.000	V = 0.000
IMRT/VMAT, n (%)	38 (76.0)	37 (74.0)	χ^2 = 0.040	0.842	V = 0.020
Removable partial denture, n (%)	31 (62.0)	28 (56.0)	χ^2 = 0.165	0.684	V = 0.041

TABLE 4: Comparison of clinical characteristics, salivary function, and prosthetic satisfaction according to xerostomia severity.

Data are presented as mean ± standard deviation (SD), median (interquartile range (IQR)), or number (percentage), as appropriate. Participants were categorized into lower- and higher-xerostomia groups according to the median Xerostomia Inventory score (score 29). Continuous variables between the two groups were compared using the Mann–Whitney U test and independent t-test, and categorical variables were compared using the chi-square test. A two-sided *p < 0.05 was considered statistically significant. Effect sizes are presented as rank biserial, Cohen's d, and Cramer's V.

IMRT: intensity-modulated radiotherapy; VMAT: volumetric-modulated arc therapy.

Spearman's correlation analysis demonstrated a strong inverse association between the Xerostomia Inventory score and overall prosthetic satisfaction ($\rho = -0.680$, $p < 0.001$), indicating that greater subjective xerostomia was associated with lower prosthetic satisfaction. Unstimulated salivary flow showed a significant positive correlation with overall prosthetic satisfaction ($\rho = 0.690$, $p < 0.001$). Xerostomia Inventory score was also negatively correlated with comfort ($\rho = -0.601$), retention/stability ($\rho = -0.649$), chewing ability ($\rho = -0.621$), speech ($\rho = -0.684$), and appearance ($\rho = -0.617$), with all correlations statistically significant ($p < 0.001$). The radiotherapy dose was positively correlated with xerostomia severity ($\rho = 0.259$, $p = 0.009$) and negatively correlated with unstimulated salivary flow ($\rho = -0.319$, $p = 0.001$). Similarly, the longer the time since radiotherapy, the greater the xerostomia ($\rho = 0.379$, $p < 0.001$) and the lower the salivary flow ($\rho = -0.359$, $p < 0.001$). Neither age nor duration of prosthesis use showed a significant correlation with overall prosthetic satisfaction (Table 5).

Variable 1	Variable 2	Spearman's ρ	p-value
Xerostomia Inventory score	Overall prosthetic satisfaction	−0.680	< 0.001*
Unstimulated salivary flow	Overall prosthetic satisfaction	0.690	< 0.001*
Xerostomia Inventory score	Unstimulated salivary flow	−0.762	< 0.001*
Xerostomia Inventory score	Comfort	−0.601	< 0.001*
Xerostomia Inventory score	Retention/stability	−0.649	< 0.001*
Xerostomia Inventory score	Chewing ability	−0.621	< 0.001*
Xerostomia Inventory score	Speech	−0.684	< 0.001*
Xerostomia Inventory score	Appearance	−0.617	< 0.001*
Radiotherapy dose	Xerostomia Inventory score	0.259	0.009*
Time since radiotherapy	Xerostomia Inventory score	0.379	< 0.001*
Radiotherapy dose	Unstimulated salivary flow	−0.319	0.001*
Time since radiotherapy	Unstimulated salivary flow	−0.359	< 0.001*
Age	Overall prosthetic satisfaction	0.070	0.492
Duration of prosthesis use	Overall prosthetic satisfaction	−0.002	0.984

TABLE 5: Correlations between xerostomia, salivary flow, radiotherapy-related variables, and prosthetic satisfaction.

Spearman's rank correlation test was used to assess associations between the Xerostomia Inventory score, unstimulated whole salivary flow rate, radiotherapy-related variables, and patient-reported prosthetic satisfaction outcomes. A two-sided *p < 0.05 was considered statistically significant.

Discussion

The present study demonstrated a clear association between post-radiotherapy salivary dysfunction and patient-reported satisfaction with removable dental prostheses among oral cancer survivors. Participants demonstrated both subjective symptoms of xerostomia and objectively reduced salivary secretion, and greater salivary dysfunction was associated with poorer overall prosthetic satisfaction. These findings highlight the importance of salivary function as an integral component of successful prosthetic rehabilitation after cancer treatment [5-7]. Although conventional prosthodontic assessment focuses largely on factors such as denture fit, retention, occlusion, and esthetics, these mechanical considerations may not fully explain the patient's experience when the oral environment has been substantially altered by radiotherapy.

The relationship between xerostomia and prosthetic satisfaction is biologically plausible. Saliva contributes to the lubrication of the oral mucosa and denture-bearing tissues and plays an important role in adhesion and cohesion between the denture base and mucosal surfaces. Reduction in salivary secretion due to radiotherapy can therefore compromise denture retention and stability while simultaneously increasing friction between the prosthesis and mucosa [15]. Patients with reduced salivary lubrication may experience mucosal discomfort, difficulty tolerating the denture, and greater difficulty during mastication and speech. Previous literature has similarly identified xerostomia as an important factor affecting removable denture performance and patient satisfaction [16]. A systematic review by Tanaka et al. [9] concluded that xerostomia may adversely influence removable denture performance, particularly functional outcomes such as chewing, speaking, and retention. This supports the present finding that salivary dysfunction was associated not only with overall satisfaction but also with several individual prosthetic domains.

The association observed across comfort, retention/stability, chewing ability, speech, and appearance further emphasizes that the consequences of xerostomia extend beyond a single mechanical property of prostheses. Reduced lubrication may directly affect comfort and retention, whereas difficulties in mastication and speech may arise from a combination of impaired denture stability, altered mucosal sensation, and reduced oral lubrication [17]. The influence on appearance may be less direct and could reflect an overall reduction in satisfaction with the prosthesis rather than a direct effect of salivary dysfunction on the denture esthetics. Similar observations have been reported among conventional denture wearers, in whom xerostomia is associated with poorer oral function and reduced satisfaction with dentures [18]. However, the present population is clinically distinct because radiotherapy can produce persistent

changes in salivary gland function and oral tissues, potentially exacerbating the consequences of dryness.

The findings regarding radiotherapy exposure provide additional support for the proposed mechanism. Greater radiotherapy exposure was associated with greater subjective xerostomia and reduced salivary flow. This is consistent with established evidence demonstrating that radiation-induced salivary gland injury depends substantially on the amount of radiation received by glandular tissues [3,4]. Salivary glands are particularly vulnerable to radiation damage, and exposure can produce acinar-cell dysfunction, vascular injury, inflammation, and subsequent structural changes [19]. Although modern techniques such as IMRT and VMAT can reduce unnecessary radiation exposure to normal tissues, clinically important salivary dysfunction may persist when the major salivary glands receive substantial treatment exposure [3]. Jensen et al. [15] have identified persistent salivary gland hypofunction and xerostomia as important long-term complications of head-and-neck cancer treatment.

An important feature of the present study was the simultaneous assessment of subjective xerostomia and objective salivary flow. These measures should not be considered interchangeable. Patients may report substantial oral dryness despite relatively preserved salivary secretion, whereas some patients with reduced flow may report fewer symptoms. Subjective xerostomia is influenced by oral sensory perception, psychological factors, medication use, and individual adaptation, whereas salivary flow provides an objective measure of glandular function [20]. The strong relationship observed between these complementary measures in the present cohort nevertheless suggests that both provide clinically useful information when evaluating oral cancer survivors requiring prosthetic rehabilitation.

The lack of a meaningful relationship between prosthesis use duration and overall satisfaction suggests that simply becoming accustomed to a removable prosthesis may not overcome the functional consequences of persistent salivary dysfunction. Similarly, the absence of an important association with age indicates that prosthetic dissatisfaction in this population should not be attributed solely to older age. Instead, the altered oral environment following radiotherapy may represent a more clinically relevant determinant of prosthetic experience.

Clinical implications and limitations

These findings have important clinical implications for the rehabilitation of oral cancer survivors. Salivary function should be routinely assessed during post-radiotherapy prosthodontic care using both patient-reported symptoms and objective measures of salivary secretion, as recommended by current clinical guidelines [21]. Management should be individualized according to the severity of salivary dysfunction and may include saliva substitutes, topical mucosal lubricants, salivary stimulation, and appropriate pharmacological interventions, such as pilocarpine, when indicated [22]. Recent evidence also suggests that although several interventions have demonstrated potential benefits, treatment effects remain variable, and the overall evidence is heterogeneous [23]. Additional preventive measures should include appropriate denture adhesives for adequately fitted prostheses, prevention and management of oral candidiasis, and high-concentration topical fluoride for patients with remaining natural teeth, particularly removable partial denture abutments. Careful assessment of prosthesis fit and regular mucosal examination are also essential to minimize denture-related trauma, particularly in patients at risk of osteoradionecrosis. The timing of definitive denture fabrication should be individualized according to tissue healing and stability following radiotherapy. Implant-retained prostheses may be considered in selected patients after careful evaluation of radiation exposure and osteoradionecrosis risk. Therefore, prosthodontic rehabilitation should be integrated with appropriate management of xerostomia and coordinated interdisciplinary follow-up to optimize comfort, function, and long-term oral health.

Nevertheless, this study has some limitations. Its cross-sectional design prevents the establishment of causal relationships between radiotherapy, salivary dysfunction, and prosthetic satisfaction. The single-center setting may limit generalizability, and residual confounding by tumor location, surgical treatment, medications, smoking, prosthesis design, and individual expectations cannot be excluded. The absence of a non-irradiated denture-wearing comparison group also limits the ability to distinguish radiotherapy-related effects from other influences on prosthetic satisfaction. Furthermore, satisfaction was assessed using a non-validated, patient-reported NRS, and objective assessments of prosthesis quality and oral mucosal condition were not performed. The lack of salivary gland-specific radiation dosimetry prevented evaluation of dose-related salivary changes.

The requirement of at least three months of prosthesis use may have introduced selection bias by excluding patients who discontinued use because of severe xerostomia, discomfort, or inadequate retention. Thus, survivors experiencing greater prosthetic difficulties may have been underrepresented. Potential survivorship bias also cannot be excluded. Additionally, outcomes were not analyzed separately by prosthesis type, although differences in design, residual dentition, and post-resection anatomy may influence satisfaction. Finally, multiple outcome assessments may have increased the risk of type I error. Future multicenter prospective studies incorporating appropriate comparison groups, validated patient-reported measures, objective prosthetic assessments, gland-specific dosimetry, and prosthesis-type-specific analyses are warranted.

Conclusions

Post-radiotherapy salivary dysfunction was significantly associated with reduced satisfaction with removable dental prostheses among oral cancer survivors. Both subjective xerostomia and objectively reduced salivary flow were associated with lower overall prosthetic satisfaction and poorer ratings across multiple functional domains. These findings highlight the association between salivary function and patient-reported prosthetic satisfaction and support the importance of assessing salivary function during post-cancer prosthetic rehabilitation. Future interventional studies should evaluate whether appropriate management of salivary dysfunction, alongside individualized prosthetic care, can improve patient-reported outcomes.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Iqbal Kaur, Aarifa F. Afroz, Madhura Bhave Joshi, Ajit Singh

Drafting of the manuscript: Iqbal Kaur, Angel Angel, Madhura Bhave Joshi, Sameer Chauhan

Critical review of the manuscript for important intellectual content: Iqbal Kaur, Aarifa F. Afroz, Angel Angel, Madhura Bhave Joshi, Sameer Chauhan, Ajit Singh

Acquisition, analysis, or interpretation of data: Aarifa F. Afroz, Angel Angel, Sameer Chauhan, Ajit Singh

Supervision: Aarifa F. Afroz

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. The Institutional Ethical Committee of Pt. B. D. Sharma PGIMS Rohtak issued approval BREC/24/501. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

Acknowledgements

The authors acknowledge the use of Paperpal (Cactus Communications, Mumbai, India) for English language editing and improving the clarity of the manuscript. The tool was not used for study design, data collection, data analysis, interpretation of results, or manuscript conclusions. All scientific content and final editorial decisions were made by the authors.

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