

Tracking Changes in Oral Health-Related Quality of Life Before, During, and After Radiotherapy in Tongue Squamous Cell Carcinoma: A Case Series

Irna Sufiawati¹, Novi Indriyani², Imme Kris Wicaksono², Emails Denta³

¹Department of Oral Medicine, Faculty of Dentistry, Universitas Padjadjaran, Bandung, West Java, Indonesia; ²Oral Medicine Residency Program, Faculty of Dentistry, Universitas Padjadjaran, Bandung, West Java, Indonesia; ³Department of Radiology, Radiation Oncology Sub-Division, Dr. Hasan Sadikin Central General Hospital, Bandung, West Java, Indonesia

Correspondence: Irna Sufiawati, Department of Oral Medicine, Faculty of Dentistry Universitas Padjadjaran, Jl. Sekeloa Selatan No. 1, Bandung, West Java, 40132, Indonesia, Email irna.sufiawati@fkg.unpad.ac.id

Background: Tongue squamous cell carcinoma (TSCC) is the most common type of oral cancer. Effective and patient-centered management is essential to reduce mortality, improve survival, and enhance oral health-related quality of life (OHRQoL).

Purpose: To assess OHRQoL and pain levels in TSCC patients across radiotherapy phases and the impact of supportive care on treatment adherence and patient well-being.

Case Report: Four patients presented with painful, non-healing tongue ulcers of 4–8 months' duration and were referred to the Oral Medicine Clinic. All were diagnosed with TSCC and underwent radiotherapy. OHRQoL and pain levels were assessed using the oral health impact profile-14 (OHIP-14) and visual analogue scale (VAS), before, during, after radiotherapy. Common intraoral side effects included oral candidiasis, mucositis, and xerostomia, all of which impacted patients' comfort and adherence to ongoing treatment.

Case Management: Management of radiotherapy-induced side effects included nystatin oral suspension, 0.025% hyaluronic acid mouthwash, diphenhydramine HCl, and artificial saliva gel. Individualized care plans were developed based on patient feedback and treatment tolerance. All patients demonstrated clinical improvement in oral lesions within 1–7 weeks. OHIP-14 and VAS scores improved before treatment (OHIP-14: 30–44; VAS: 9), during treatment (OHIP-14: 27–36; VAS: 8), and one month afterward (OHIP-14: 10–15; VAS: 1–5).

Conclusion: The integration of proactive and personalized supportive oral care during radiotherapy can significantly improve OHRQoL and reduce pain levels, facilitating better treatment adherence and patient satisfaction. These findings support the importance of multidisciplinary collaboration and proactive symptom management in TSCC care.

Keywords: OHIP-14, oral cancer, oral complications of radiotherapy, quality of life assessment, visual analogue scale

Introduction

Tongue squamous cell carcinoma is the most common form of oral cancer, with a global prevalence of approximately 25–30% in India, 10–15% in China, 10–15% in Indonesia, 5–7% in Japan, 10–20% in Europe, and 2–4% in the United States.^{1,2} Our recent study also similarly found that the tongue was the most commonly affected site, accounting for 68.8% of the cases.³ The major risk factors for the development of tongue cancer are smoking, alcohol consumption, and, more recently, infection with human papillomavirus (HPV) and chronic mechanical trauma.^{4,5} The prognosis for tongue cancer remains poor, with 5-year survival rates of around 50%.⁶

The primary treatments for tongue cancer include surgery, chemotherapy, and radiotherapy, administered either individually or in combination. The main objective of these therapies is to achieve complete disease control while preserving or restoring function. In addition to conventional therapies, diode lasers have been used in oral and maxillofacial procedures, particularly for early-stage oral cancer. This modality offers benefits such as precision, reduced

bleeding, minimal discomfort, and faster healing. Diode laser has also been associated with shorter hospital stays in early-stage oral and oropharyngeal cancer.⁷

However, despite their curative intent, chemotherapy and/or radiotherapy often result in significant adverse effects, particularly in the oral cavity. Common oral complications associated these treatments include oral mucositis, xerostomia, secondary infections, dental caries, loss of taste, and osteoradionecrosis. These complications can cause substantial patient morbidity and may even contribute to mortality. Several studies have highlighted the significant impact of tongue cancer therapies on the quality of life.^{8–11}

Oral health-related quality of life (OHRQoL) reflects the impact of oral health on an individual's overall well-being, encompassing physical health, psychological status, social relationships, and daily functioning. Given the profound effects of treatment on oral function, speech, nutrition, and social engagement, capturing the patient's perspective is essential for guiding supportive care and improving adherence to treatment. To improve OHRQoL, treatment strategies must not only manage the physical side effects of cancer therapy but also provide sufficient emotional and psychosocial support.

The oral health impact profile-14 (OHIP-14) is the most widely used questionnaire for evaluating OHRQoL, while pain levels are measured using the visual analogue scale (VAS), both of which have been previously validated.^{12,13} Patient-reported outcome measures (PROMs), including OHIP-14 and VAS, provide insight into both clinical progress and patients' perceptions of their condition, which are essential for encouraging treatment adherence and delivering personalized care.

This case series aims to assess OHRQoL and pain levels in patients with TSCC throughout radiotherapy, using OHIP-14 and the VAS as patient-reported outcome measures.

Case Report

Case One

A 68-year-old female patient presented to the Oral Medicine Clinic with a chief complaint of persistent mouth soreness lasting approximately eight months. The patient had a long-standing history of smoking. Histopathological examination confirmed a moderately differentiated TSCC. A radiotherapy plan consisting of 33 fractions was initiated. The tumor proportion score (TPS) was performed before radiotherapy to optimize the radiation dose.

Before radiotherapy, the patient reported severe oral discomfort, with an OHIP-14 score of 35 and a VAS pain score of 9, both indicating significant interference with eating and daily functioning. After 20 sessions of radiotherapy, the OHIP-14 score decreased to 30, and the VAS score to 7, reflecting a slight reduction in discomfort. Clinical examination revealed white plaques and erythematous ulcerations on the lower labial mucosa. These lesions were consistent with oral mucositis and xerostomia. Baseline oral health assessment revealed an oral hygiene index-simplified (OHI-S) score of 1.3 (fair) and a decayed, missing, and filled teeth (DMFT) index of 4 (moderate).

To manage these complications, the patient was treated with gel-based artificial saliva and 0.025% hyaluronic acid mouthwash. She adhered to the recommended regimen, and one month after completing radiotherapy, she reported marked clinical improvement. Her OHIP-14 score significantly improved to 10, and her VAS pain score dropped to 3, indicating substantial relief in symptoms and enhanced quality of life (Figure 1). The improvements were associated with consistent symptom management and patient engagement in care.

Case Two

A 47-year-old patient presented with several painful mouth ulcers and difficulty swallowing after the fifth session of radiotherapy. The patient had been diagnosed with tongue cancer early last year and had completed six cycles of chemotherapy. Histological findings were consistent with moderately differentiated TSCC. Following surgical treatment for tongue cancer, the patient had been dependent on a nasogastric tube (NGT) for nutrition, which had not yet been removed. A total of 33 radiotherapy fractions were planned. TPS was assessed prior to radiotherapy to establish the optimal radiation dose.

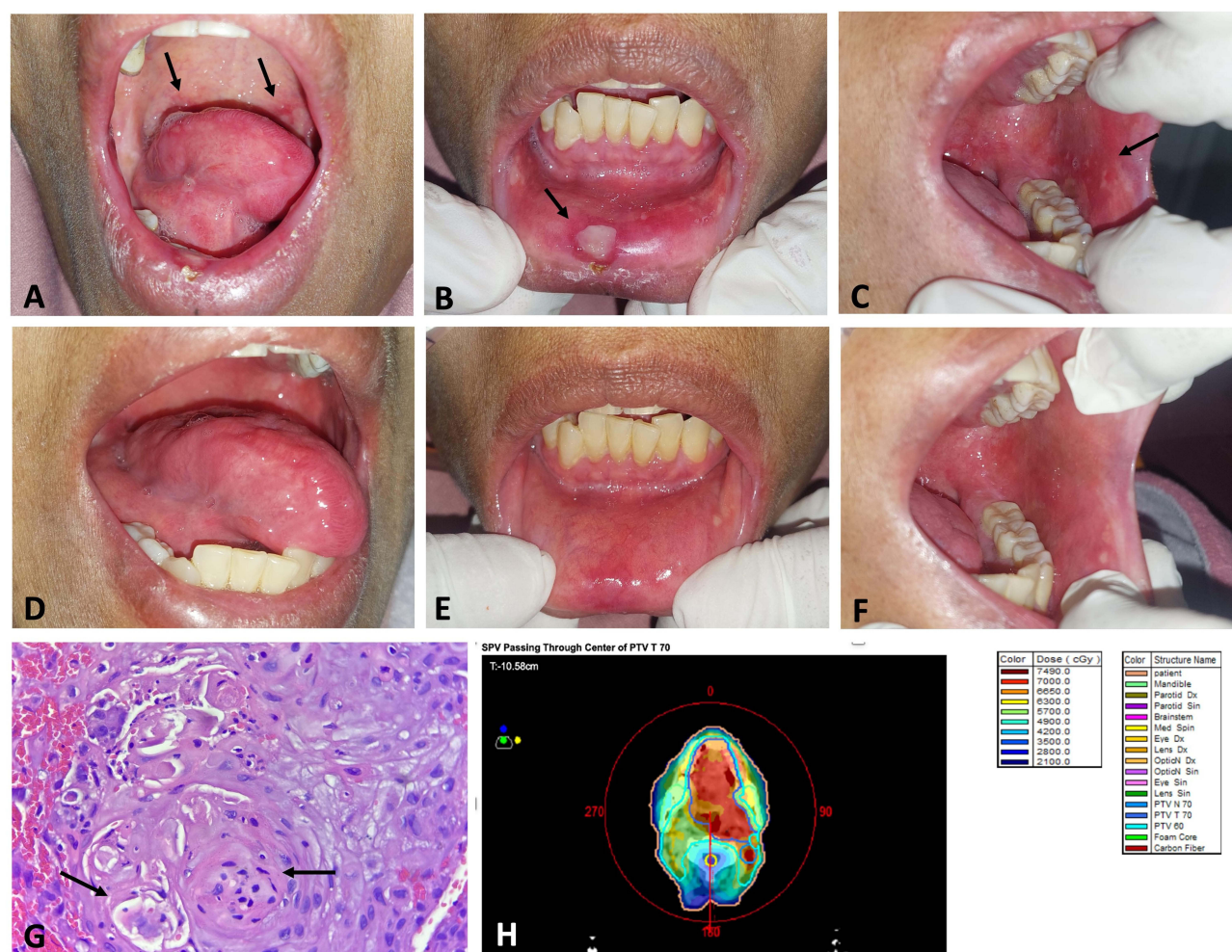


Figure 1 Intraoral clinical presentation, histopathological findings, and TPS in Case 1. **(A–C)** After 20 fractions of radiotherapy, the patient developed multiple irregular ulcers measuring approximately 3 mm to 1 cm in diameter, surrounded by diffuse erythema, located on the oropharynx, labial mucosa, and left buccal mucosa. The clinical presentation is consistent with oral mucositis, a common adverse effect during radiotherapy. **(D–F)** At the one-month follow-up, the lesions showed clinical improvement. **(G)** Histopathological examination revealed moderately differentiated SCC, characterized by the presence of keratin pearl formation. This indicates tumor cells undergoing squamous differentiation and keratinization, which is a hallmark feature of this histologic grade of SCC. **(H)** In a patient with locally advanced TSCC, TPS was performed before curative intent radiotherapy to determine the appropriate radiation dose. The gross tumor Planning Target Volume (PTV T 70 and PTV N 70), shown in shaded red-Orange, received 66–70 Gy. The high-risk Clinical Target Volume (CTV 60), shown in shaded light green, was treated to 60 Gy, covering the entire tongue and bilateral neck nodes at levels I–IV. Calculating the dose distribution received by surrounding healthy structures, such as the parotid glands, mandible, spinal cord, eyes, lenses, and brainstem, is also a crucial aspect of radiotherapy planning.

Before the start of radiotherapy, the patient reported an OHIP-14 score of 30 and a VAS pain score of 9, indicating significant discomfort. By the 11th session, the OHIP-14 score had slightly improved to 27. However, the patient continued to report substantial tongue pain that interfered with daily functioning.

Intraoral examination revealed white plaques and reddish ulcerated areas on the tongue and buccal mucosa. The lesions were diagnosed as oral mucositis and acute pseudomembranous candidiasis. The patient had an OHI-S score of 3.3 (poor) and a DMFT of 4.2 (moderate). Management included nystatin oral suspension (100,000 IU/mL), 0.9% sodium chloride rinses, and diphenhydramine HCl. Pain assessment using the VAS revealed a score of 8 at this stage.

Upon completing all 33 radiotherapy sessions, the patient experienced marked clinical improvement. The mucosal lesions had resolved significantly, and the patient was able to resume swallowing solid foods. The OHIP-14 score improved to 17, and the VAS pain score decreased to 1 (**Figure 2**), reflecting substantial relief in symptoms and enhancement in oral function and quality of life.

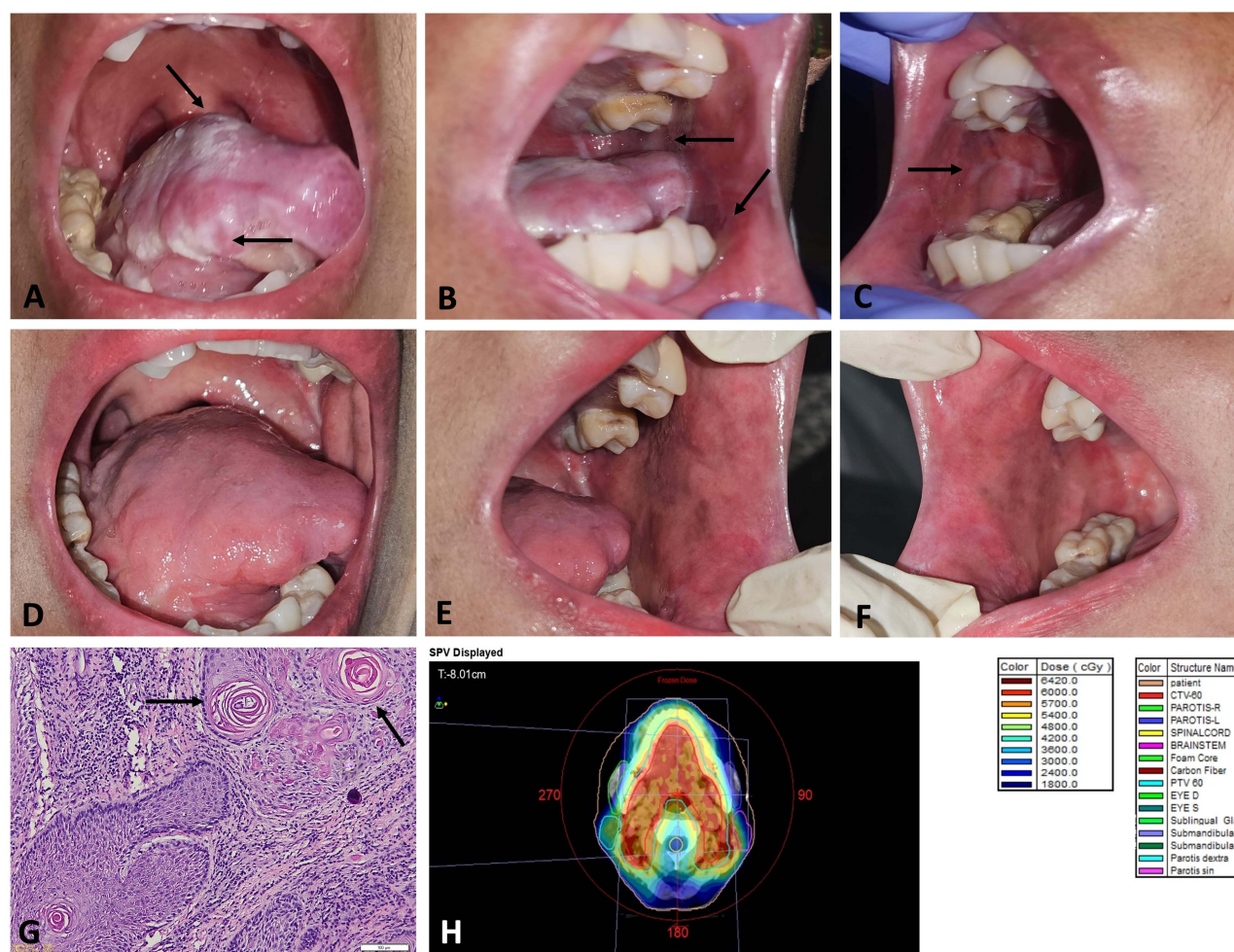


Figure 2 Intraoral clinical presentation, histopathological findings, and TPS in Case 2. (A–C) The arrows point to white plaques observed on the dorsal tongue, left buccal mucosa, and right buccal mucosa after 11 fractions of radiotherapy, consistent with oral mucositis and acute pseudomembranous candidiasis. (D–F) At the second follow-up visit, the lesions were completely healed. (G) Histopathological examination showed moderately differentiated SCC. The arrow points to a keratin pearl, a hallmark feature characterized by squamous differentiation and keratinization. (H) A patient with locally advanced TSCC was treated with curative intent radiotherapy, preceded by TPS to determine the appropriate radiotherapy dose. The gross tumor disease (PTV T 70 and PTV N 70), shown in shaded red-Orange, received 66–70 Gy, while the high-risk (CTV 60), shown in shaded light green, was treated to 60 Gy, covering the entire tongue and bilateral neck nodes levels I–IV. Calculation of the dose distribution to surrounding healthy structures (such as the parotid glands, mandible, spinal cord, eyes, lenses, and brainstem) was also a crucial component of the radiotherapy planning process.

Case Three

A 76-year-old male patient presented to the Oral Medicine Clinic with a complaint of a tongue lump that had developed four months earlier, following trauma from a fractured tooth. The trauma had caused a persistent painful sore. Although the tooth had been extracted, the sore did not heal. He also reported a weight loss of four kilograms over the past three months.

The patient had a medical history of hypertension and diabetes mellitus, both of which were well-controlled with regular medication. He had a history of smoking since adolescence and had quit five years prior. Histopathological examination confirmed a diagnosis of moderately differentiated TSCC. A total of 33 fractions of radiotherapy were planned. We evaluate TPS before starting radiotherapy to adjust the radiation dose.

Prior to radiotherapy, the OHIP-14 score was 44, indicating severe oral pain and discomfort that affected eating and taste perception. The stinging sensation significantly interfered with daily functioning. Pain was rated at 9 on the VAS. After 20 radiotherapy sessions, the OHIP-14 score decreased to 35, although the patient continued to experience oral discomfort and burning sensations.

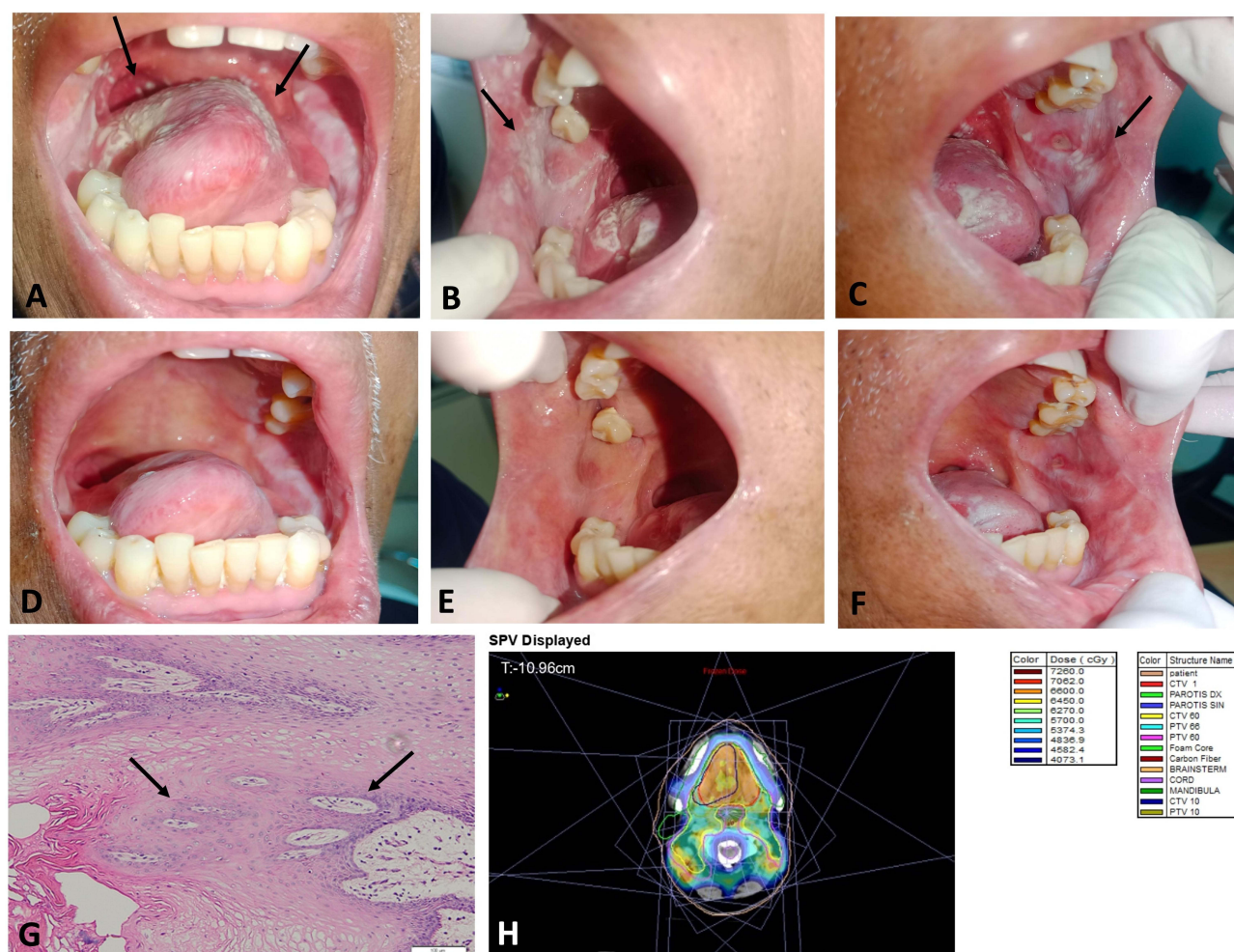


Figure 3 Intraoral clinical presentation, histopathological findings, and TPS in Case 3. (A–C) Intraoral examination after 20 fractions of radiotherapy showed multiple ulcers, as indicated by the arrows, accompanied by a removable white plaque, leaving reddish areas on the right and left buccal mucosa and the dorsum of the tongue, consistent with oral mucositis and acute pseudomembranous candidiasis. (D–F) At the one-month follow-up, the lesions showed partial improvement. (G) Histological examination revealed moderately differentiated SCC, with keratin pearl formation. The arrow highlights the significance of this feature, which indicates squamous differentiation and keratinization, which are hallmark characteristics of moderately differentiated SCC. (H) The TPS was performed before radiotherapy to determine the appropriate dose in a patient with TSCC, who was subsequently treated with definitive radiation therapy. A total dose of 66 Gy was delivered to the gross tumor disease (PTV 66), shown in shaded red-Orange, while the high-risk area (CTV 60), shown in light green and encompassing the entire tongue and bilateral neck nodes levels I–IV, was treated to 60 Gy.

Intraoral examination revealed white plaques and reddish ulcerated areas on the left buccal mucosa. The lesions were diagnosed as oral mucositis and acute pseudomembranous candidiasis. OHI-S was 1.1 (good), while DMFT reached 9 (very high). The patient was treated with nystatin oral suspension (100,000 IU) and 0.025% hyaluronic acid mouthwash. One month after completing radiotherapy, the OHIP-14 score improved to 12, the lesions had healed, and the patient was able to eat solid food again, though occasional soreness persisted. The VAS pain score decreased to 3 (Figure 3).

Case Four

A 71-year-old female patient presented to the Oral Medicine Clinic with a chief complaint of a painful sore on her tongue that had persisted for eight months following trauma from a fractured tooth. Although the fractured tooth had been extracted one month earlier, the ulcers did not heal. Histopathological examination confirmed a diagnosis of moderately differentiated TSCC. A total of 33 fractions of radiotherapy were planned. Before radiotherapy, TPS is calculated to optimize the treatment dose. The patient had a medical history of hypertension, which was managed with regular candesartan therapy.

Before radiotherapy, the OHIP-14 score was 40, indicating severe tongue pain, especially during eating and speaking, which significantly impaired daily activities. The VAS pain score was 9. After 20 sessions of radiotherapy, the OHIP-14 score slightly improved to 36. The patient developed trismus (restricted mouth opening), which further hindered eating. A painful white plaque appeared on the tongue. The VAS pain score at this stage was 8.

Intraoral examination revealed lesions consistent with oral mucositis, acute pseudomembranous candidiasis, and mild xerostomia. The patient had an OHI-S score of 1.0 (good) and a DMFT of 3 (moderate). Treatment included nystatin oral suspension (100,000 IU) and 0.025% hyaluronic acid mouthwash, and gel-based artificial saliva. One month after completing radiotherapy, the lesions showed improvement, and the OHIP-14 score decreased to 15. The patient reported reduced pain, although mouth opening remained. The VAS pain score was 5 (Figure 4).

A comprehensive overview of clinical outcomes and OHRQoL measures for the four patients with TSCC is presented in Table 1. It summarizes anatomical and histopathological findings, treatment modalities, oral complications, and changes in OHRQoL scores before, during, and after radiotherapy.

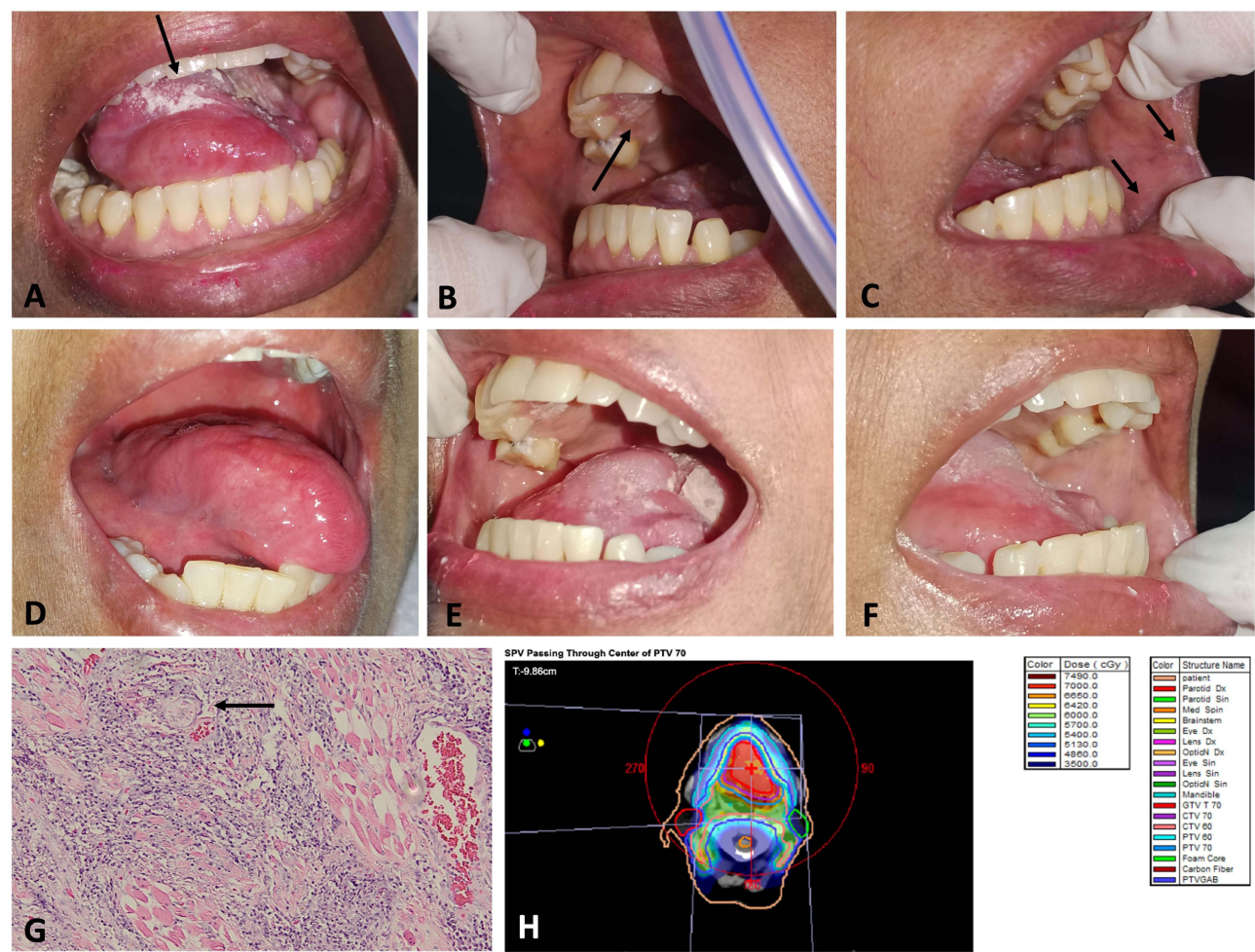


Figure 4 Intraoral clinical presentation, histopathological findings, and TPS in Case 4. (A–C) After 20 fractions of radiotherapy, the patient developed white plaques and erythematous areas on the buccal mucosa and dorsal surface of the tongue, diagnosed as oral mucositis and acute pseudomembranous candidiasis. (D–F) At the one-month follow-up, during routine assessment, the lesions showed significant improvement. (G) Histopathological examination of the tongue lesion confirmed moderately differentiated SCC. The arrow highlights a keratin pearl, a characteristic feature indicative of squamous differentiation and keratinization. (H) The TPS calculated the dose distribution coverage for both the target tumor and surrounding structures. The gross disease PTV T 70 and PTV N 70, shown in shaded red-Orange, received 66–70 Gy as a curative dose. The high-risk CTV 60, shown in shaded light green, received 60 Gy and encompasses the entire tongue and bilateral neck nodes levels I–IV. The surrounding vital structures near the target tumor, referred to as organs at risk (OARs), include the eyes, lenses, optic nerves, brainstem, spinal cord, parotid glands, and mandible. Careful evaluation of the dose distribution to these OARs is crucial to minimize potential side effects.

Table 1 Summary of Clinical Characteristics, Management, Oral Complications, and OHRQoL in Four Patients with TSCC Throughout Radiotherapy

Case	Histopathological Findings	Cancer Treatment	Oral Cavity Complications	OHIP-14 Score (Before/During/After)	VAS Pain Score (Before/During/After)	Treatment for Oral Lesions	Key Clinical Outcomes
Case 1	Moderately differentiated	33 fractions RT	Oral mucositis, moderate xerostomia	35/30/10	9/7/3	Artificial saliva gel, HA mouthwash	Lesions improved, pain reduced, dry mouth persisted, improved swallowing, mild speech limitation
Case 2	Moderately differentiated	6 cycles chemo, 33 fractions RT	Acute pseudomembranous candidiasis, mucositis	30/27/17	9/8/1	Nystatin, NaCl rinse, diphenhydramine	Lesions improved, pain reduced, swallowing normalized, mild speech limitation
Case 3	Moderately differentiated	33 fractions RT	Acute pseudomembranous candidiasis, mucositis	44/35/12	9/8/3	Nystatin, HA mouthwash	Lesions improved, pain reduced, improved swallowing, mild speech limitation
Case 4	Moderately differentiated	33 fractions RT	Acute pseudomembranous candidiasis, mild xerostomia	40/36/15	9/8/5	Nystatin, HA mouthwash, artificial saliva gel	Lesions improved, pain reduced, mild dry mouth persisted, improved swallowing, restricted mouth opening persists, moderate difficulty in articulation

Abbreviations: SCC, squamous cell carcinoma; RT, radiotherapy; HA, hyaluronic acid; VAS, Visual Analogue Scale; OHIP-14, Oral Health Impact Profile-14.

Table 2 Summary of Previous Studies on OHRQoL in Head and Neck Cancer Patients

Author (Year)	Sample	Study Design	OHRQoL Assessment	Key Findings
Kosgallana et al (2023) ¹⁶	Oral cancer patients (n=90)	A prospective longitudinal study	EORTC QLQ-OH15	OHRQoL worsened during radiotherapy, particularly in eating and speech, with partial recovery post-treatment
Soldera et al (2020) ¹⁷	Head and neck cancer survivors (n=90)	Cross-sectional	OHIP-14	Lower OHRQoL scores were associated with hyposalivation and advanced-stage tumors.
de Melo et al (2019) ¹⁸	HNC patients (n=130)	Cross-sectional	OHIP-14	Physical pain, disability, and functional limitation were key contributors to poor OHRQoL
Qamar et al (2024) ¹⁹	HNC-treated patients within first year post-treatment (n=79)	Cross-sectional	EORTC QLQ-H&N35	OHRQoL was negatively affected by poor oral health, with 83.5% experiencing moderate to severe mucositis and poor OH status
Lee et al (2021) ²⁰	Patients undergoing radiotherapy (n=61)	Quasi-Experimental, non-equivalent, non-synchronized	EORTC QLQ-H&N35	Significant OHRQoL differences in swallowing and speech were observed between the experimental and control groups. Oral care program significantly improved OHRQoL post-RT

Abbreviations: HNC, Head and Neck Cancer; OH, Oral Hygiene; OHIP-14, Oral Health Impact Profile-14; OHRQoL, Oral Health Related Quality of Life; RT, radiotherapy; EORTC QLQ-H&N35, the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire–Head and Neck 35.

Discussion

Radiotherapy or chemoradiotherapy are effective treatments for tongue cancer, but they can lead to several side effects. Fortunately, many of these side effects can be managed or prevented with appropriate supportive care. Before starting radiotherapy, careful treatment planning using the TPS allows for optimized radiation delivery. This advanced system optimizes radiation doses, targeting the tumor while minimizing exposure to surrounding healthy tissues, which ultimately improves the patient's quality of life.^{14,15} Furthermore, TPS helps identify areas of the oral cavity at high risk for mucosal injury, enabling clinicians to implement preventive strategies early in the treatment course. These strategies include educating patients on maintaining good oral hygiene, avoiding irritant foods, and ensuring proper nutritional intake. Such measures are crucial for improving treatment outcomes and enhancing the patient's overall quality of life during radiotherapy. Table 2 presents evidence from previous studies, which consistently highlight the impact of oral cancer and its treatment on OHRQoL. The findings support the present case series, which observed similar trends in OHRQoL outcomes among patients undergoing radiotherapy for TSCC.

All patients in this report received 33 cycles of radiotherapy. Despite precise treatment planning using TPS, several complications were observed during and after therapy, including oral mucositis, pseudomembranous candidiasis, trismus, and xerostomia. These conditions caused symptoms such as pain and a burning sensation, which significantly affected their OHRQoL. After receiving radiotherapy, all patients had high OHIP-14 scores, indicating poor oral health-related quality of life. A higher OHIP-14 score indicates a more significant negative impact on oral health,²¹ which aligns with prior reports of OHRQoL decline in head and neck cancer patients following radiotherapy or chemoradiotherapy.^{16–18}

Our results, showing enhanced OHRQoL and reduced pain after individualized supportive oral care during radiotherapy, are consistent with recent clinical evidence. Kartin et al demonstrated that a structured mucositis prevention protocol notably alleviated pain and maintained nutrition in radiotherapy patients.²² Similarly, Lee et al reported that Comprehensive oral care delivered by dental professionals led to improvements in oral health and quality of life among patients with head and neck cancer.²⁰ Together, these studies underscore the importance of early and personalized oral care interventions in managing radiotherapy-related complications in TSCC.

VAS scores further supported these findings. Most patients reported moderate to severe pain throughout radiotherapy, with some residual pain persisting even one month after treatment completion. Acute pain following radiotherapy generally subsides within 2–4 weeks, but a subset of patients, particularly older adults and females, may develop persistent or chronic pain lasting beyond 6 months. One study found that up to 30% of head and neck cancer survivors experienced chronic pain, especially those who underwent surgery in addition to radiotherapy. Chronic pain was associated with significant reductions in quality of life, affecting physical functioning, sleep quality, and emotional well-being.²³

Several supportive therapies were employed in this case series to manage complications and improve patient comfort. Three patients received 0.025% hyaluronic acid mouthwash for oral mucositis. Hyaluronic acid has well-documented anti-inflammatory and wound-healing properties. It plays an important biological role in tissue regeneration by regulating cell signaling, morphogenesis, and matrix remodeling, regulation of gene expression, and cell proliferation.²⁴ Clinical trials have demonstrated that hyaluronic acid mouthwashes, especially when combined with corticosteroids and vitamin E, effectively reduce pain and promote healing in radiotherapy-induced mucositis.²⁵ One patient received diphenhydramine-containing rinse, which has topical anesthetic effects that help relieve mucosal pain.²⁶ Pain levels in all patients decreased significantly by one month after completing radiotherapy.

Oral candidiasis was managed using nystatin oral suspension (100,000 IU), administered 2 mL four times daily. Nystatin acts by binding to ergosterol in fungal cell membranes, disrupting membrane integrity and leading to cell death.²⁷ To manage xerostomia, gel-based artificial saliva was applied to the labial and buccal mucosa as well as the floor of the mouth. These agents provided symptomatic relief by hydrating oral tissues and restoring moisture balance. Post-radiotherapy use of such gels has been shown not only to alleviate dry mouth symptoms but also to improve salivary flow, pH, and reduce *Candida* colonization.²⁸ Additionally, sodium hyaluronate-based oral rinses have demonstrated superiority over standard artificial saliva products in enhancing both subjective and objective measures of dry mouth, including increased unstimulated salivary flow.²⁹

This case series highlights the critical role of dental professionals in managing radiotherapy-induced oral complications. TSCC presents unique challenges due to the tongue's anatomical and functional importance. However, timely recognition and management of complications can significantly improve treatment tolerability and patient-reported outcomes. The observed improvements in OHIP-14 and VAS pain scores in these four patients underscore the effectiveness of targeted oral care strategies. These findings contribute to the growing evidence supporting multidisciplinary management approaches in head and neck oncology, with an emphasis on preserving patient comfort, function, and adherence to cancer therapy.

Conclusion

Our findings highlight the significant impact of radiotherapy on patients' OHRQoL in patients with tongue squamous cell carcinoma. This cancer uniquely affects both the functional and aesthetic aspects of the oral cavity. This underscores the importance of a comprehensive and multidisciplinary approach to mitigate the debilitating side effects of treatment, including mucositis, xerostomia, and candidiasis, which are particularly significant in TSCC due to the tongue's critical

role in speech and swallowing. The improvements in OHRQoL and pain scores observed in all cases demonstrate that, with appropriate supportive care, the adverse effects of radiotherapy can be managed effectively, leading to significant improvements in patient outcomes. This case series draws attention to the need for individualized, patient-centered care plans that address the specific challenges posed by TSCC, ultimately enhancing both the physical and psychological well-being of patients undergoing treatment.

Ethical Approval

Written informed consent was obtained from all patients for publication of the case report and accompanying images. All cases were conducted in accordance with the principles of the Declaration of Helsinki. Approval for the publication of this case report was also obtained from Universitas Padjadjaran.

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Disclosure

The authors report no conflicts of interest in this work.

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