"The socket that did not heal"

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Abstract

Oral squamous cell carcinoma (OSCC), accounting for over 90% of oral malignancies, may occasionally present in atypical forms that mimic benign dental conditions. One deceptive presentation is a non-healing extraction socket, where delayed healing is often misattributed to infection, traumatic extraction, or systemic factors. However, growing evidence shows that persistent sockets may conceal underlying malignancy, particularly OSCC of the gingiva or alveolar ridge. Such lesions may lack classical malignant features and instead present with subtle signs like persistent granulation tissue, mild discomfort, or irregular mucosal changes. Radiographic findings such as bone destruction, trabecular loss, or cortical discontinuity should raise suspicion. Histopathology remains essential for confirmation. Literature reviews indicate that malignancy is a frequent diagnosis in unexplained non-healing sockets, and delayed recognition often leads to advanced-stage disease. Therefore, clinicians must maintain a high index of suspicion and adopt an early biopsy approach to ensure timely diagnosis and improved patient outcomes.

Key words: Non-healing socket, oral squamous cell carcinoma

Head and neck cancers are among the ten most common cancers globally, and a large proportion of these occur within the oral cavity. Oral squamous cell carcinoma (OSCC) makes up over 90% of all oral cancers and remains a major public health challenge[(1)].

Although common sites include the lateral border of the tongue, floor of mouth, and buccal mucosa, OSCC may also affect gingiva or alveolar ridge and in rare situations may present in contexts that mimic benign dental conditions. One such "masquerading" presentation is a non-healing extraction socket. Normally, after the extraction of a tooth, the alveolar socket is expected to undergo a standard healing process, with soft-tissue closure and bone remodelling over several weeks. However, when the extraction site fails to heal in the expected timeframe, clinicians often attribute the delay to common causes such as clot dissolution, secondary infection (e.g. alveolar osteitis), retained root fragments, foreign body, or local/systemic factors interfering with healing[(2)]. Yet as documented in an increasing number of case reports/series a non-healing socket may sometimes harbour an underlying malignancy, most frequently OSCC (primary or intraosseous) rather than benign pathology[(3)].

A 78-year-old female, reported to the department with pain and swelling in the right posterior mandibular region persisting since several weeks. She also complained of difficulty in chewing on that side, which had progressively worsened. She was treated for right-sided breast carcinoma 13 years ago, with no current signs of recurrence or metastases. She has no other significant systemic illness. Her habit history included a past history of tobacco and pan-supari chewing for over a decade, which she stopped 15 years prior to presentation. The patient underwent multiple teeth extraction around five years ago. Since then, she had been experiencing persistent discomfort and incomplete healing in the region of extraction, which gradually progressed to the current symptoms.

On extraoral inspection, no gross facial asymmetry was observed. A diffuse, hard swelling was palpable on the lower right side of the mandible, extending antero-posteriorly from the corner of the lip to the angle of the mandible and supero-inferiorly from the ala-tragus line to the lower border of the mandible. The swelling was tender on palpation. There was no clinically palpable lymphadenopathy. Examination of the temporomandibular joint revealed bilaterally palpable movements without clicking or crepitus, though the patient exhibited reduced mouth opening. Intraorally, the patient was completely edentulous in both arches. A diffuse swelling was noted on the buccal aspect of the right posterior mandibular alveolar ridge corresponding to the mandibular right second premolar to second molar region. The swelling was firm, mildly tender, and non-fluctuant without pus discharge. The overlying mucosa appeared erythematous, slightly thickened, and showed an irregular surface texture. Adjacent to the swelling, a non-healing extraction socket was observed. These combined findings of persistent socket and abnormal mucosal changes warranted further investigation.

The OPG revealed an irregular radiolucency in area underlying destructive process. The CBCT imaging demonstrated a loss of normal trabecular bone pattern and evidence of cortical discontinuity in the mandibular right second premolar to second molar region. These findings indicated aggressive bone involvement and raised suspicion for a malignant or chronic inflammatory pathology. **(Figure 1)**

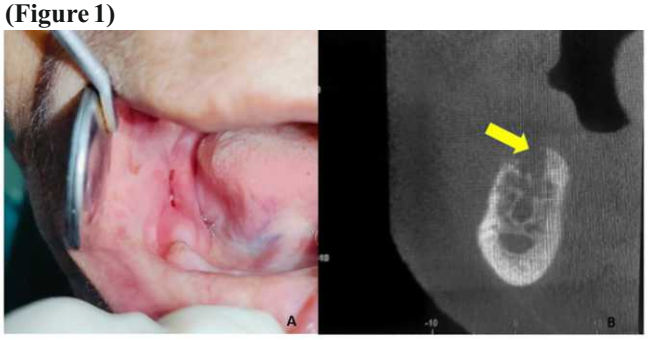

Figure.1 (A) Diffuse swelling on the right mandibular posterior region with erythematous overlying mucosa (B) loss of trabecular patter and cortical discontinuity in CBCT

Based on the clinical presentation and radiological features, several potential diagnoses were considered. Chronic osteomyelitis was suspected due to the long-standing pain and swelling. A residual cyst was also considered in view of the persistent extraction site. Medication related osteonecrosis of the jaw (MRONJ) was included due to the patient's past chemotherapy history, though no bisphosphonate use was reported. Given the bone destruction and soft tissue changes, a neoplastic process was also considered.

An incisional biopsy was taken from the area exhibiting friable mucosa and unhealed socket to establish a definitive diagnosis. Microscopic examination revealed dysplastic epithelial islands infiltrating the connective tissue stroma. Keratin pearl formation was seen, along with loss of normal epithelial maturation. Cells demonstrated an increased nuclear-cytoplasmic ratio and architectural disorganization. These histological features were strongly suggestive of keratinizing oral squamous cell carcinoma. She was directed to an oncology centre for further management. **(Figure 2)**

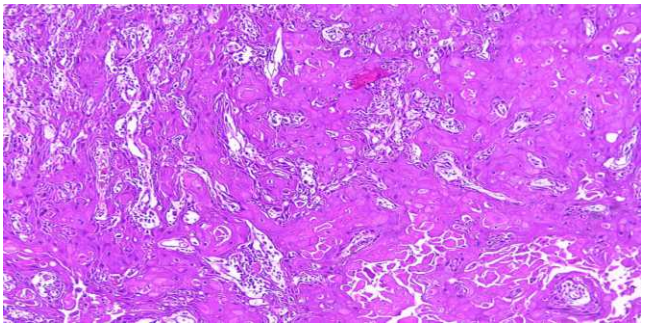

Figure.2 H and E stained section showing epithelial and keratin pearls, altered cytoplasmic ratio, and prominent

Normal healing of an extraction socket follows an orderly sequence beginning with blood clot formation, granulation tissue development, epithelialization, and gradual bone fill with subsequent remodelling. This healing process may be delayed or impaired by factors such as advanced age, systemic diseases (e.g., diabetes), smoking, local infection, traumatic extraction, and inadequate oral hygiene[3]. Clinically, proper socket management, atraumatic technique, preservation of the blood clot, infection control, and good postoperative instructions are essential to ensure uneventful recovery. However, a persistently non-healing socket warrants careful evaluation, as signs suggestive of malignant transformation include persistent pain, ulceration with indurated margins, unexplained bleeding, paraesthesia, foul smell, progressive swelling, non-resolving granulation tissue, and exposure of bone. Early identification of these red-flag features is crucial for timely biopsy and diagnosis[4].

In certain cases, following tooth extraction, carcinoma may seem to progress quickly and expand out of the socket. This rapid appearance is thought to result from previously unnoticed neoplastic cells that had been spreading along the periodontal ligament, becoming unrestrained and more apparent once the tooth is removed[5]. Often, gingival carcinoma does not initially present with the typical features of a malignant lesion. It may be painless or occasionally associated with discomfort as presented in the current case mentioned. Although the tumour most frequently arises in edentulous regions, it can also develop in areas where teeth are still present[6]. A recent review of non-healing extraction sockets (spanning decades of literature) identified 50 human cases, among which malignancy (primary and metastatic) was the most common definitive diagnosis[7]. Because OSCC occurring in extraction sites can closely resemble benign inflammatory changes or routine post-extraction healing, its diagnosis is often significantly delayed. One study noted that among patients who were eventually diagnosed with OSCC, the mean interval between the initial dental intervention and the first oncologic evaluation exceeded eight weeks; by that time, all patients already exhibited advanced disease, typically stage IV[8]. This highlights how early stage OSCC may remain asymptomatic or manifest only with subtle clinical features such as mild discomfort, delayed healing, excessive granulation tissue, or a persistent ulcer. Therefore, any extraction socket that fails to heal within the expected physiological timeframe should raise immediate concern. In fact, the literature documents multiple instances where OSCC has initially presented as a non-healing extraction socket, underscoring the importance of maintaining a high index of suspicion in such cases[9]. Therefore, for dental practitioners and oral surgeons who are often the first clinicians to evaluate extraction sites maintaining a low

threshold for biopsy, especially in sockets failing to heal in spite of appropriate local care could permit earlier diagnosis, timely referral, and improved prognosis. This underlines the critical need to consider OSCC in the differential diagnosis of non-healing extraction sockets, especially when healing is delayed or there is bone loss, granulation tissue, persistent pain and unusual radiographic changes.

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