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# PREVALENCE AND CLINICAL OUTCOMES OF OSTEOMYELITIS OF THE JAW IN POST-TRAUMATIC AND POST-EXTRACTION CASES

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**Abstract**

Post-traumatic and post-extraction osteomyelitis of the jaw remains a significant maxillofacial challenge, particularly where delayed presentation and microbial variability influence disease progression. This investigation evaluated the prevalence and clinical outcomes of these two etiological groups using a prospective analytical design to identify statistically meaningful distinctions in disease behaviour. The objective was to determine differential risk patterns, treatment response, and healing trajectories while emphasising newly observed trends in early radiographic transformation and microbial virulence profiles. A total of 124 patients were analysed, revealing a notably higher prevalence of cortical perforation, sequestration burden, and delayed mucosal healing in post-traumatic cases compared with post-extraction counterparts ($p < 0.01$). Mean time to clinical resolution was significantly prolonged in trauma-related disease, whereas post-extraction cases demonstrated earlier granulation stability and superior antibiotic responsiveness ($p < 0.05$). These outcomes reinforce the concept that etiological classification directly informs pathological severity and suggests that post-traumatic osteomyelitis may involve a more complex interplay of ischemic compromise and polymicrobial colonisation. The findings provide an updated perspective that enhances current understanding of etiological risk stratification and supports refinement of diagnostic thresholds in maxillofacial infection management. This study demonstrates that early prediction of clinical trajectory is feasible through combined radiographic-clinical profiling, offering a novel contribution to the field.

**Keywords:** jaw osteomyelitis, post-traumatic infection, post-extraction complications

## INTRODUCTION

Osteomyelitis of the jaw has re-emerged as a focal point of contemporary maxillofacial research due to evolving microbial patterns, increasing traumatic injuries, and shifts in dental extraction practices. Although considered a historically understood entity, the condition has undergone notable epidemiological and clinical transformation over the last decade. Advancements in imaging, expanding knowledge on biofilm

behaviour, and improved soft-tissue management have highlighted new complexities in disease progression. Post-traumatic and post-extraction origins remain the most frequently documented etiologies, yet contrasting biomechanical, vascular, and microbial pathways underpin their development. These divergences have created a growing need for analytical separation rather than combining these cases into a singular diagnostic framework. Modern clinical observations have shown that trauma-related infections exhibit more structurally aggressive behaviour, while extraction-related lesions often present with early microbial dominance but comparatively lower destructive potential. Such distinctions, however, have not been comprehensively quantified in recent clinical literature despite their relevance to treatment algorithms.[1-4]

Current data increasingly indicate that osteomyelitis is not solely a consequence of pathogenic exposure but also reflects a broader interplay of host vascular resilience and bone microarchitecture. Post-traumatic disease typically arises from direct disruption of medullary blood supply, cortical collapse, or retained foreign bodies that create a favourable environment for anaerobic expansion. Conversely, post-extraction osteomyelitis is often associated with residual socket debris, limited mucosal closure, or systemic conditions that delay clot stabilization. The advent of widespread antimicrobial use has altered pathogen prevalence, creating more resistant strains of anaerobes and facultative organisms capable of evading conventional therapies. Studies published within the last few years have consistently underscored that therapeutic success now depends not only on microbial elimination but also on precise identification of the initiating mechanism. This has resulted in a renewed emphasis on etiological classification as a prognostic tool in jaw infection management.[5-8]

Emerging radiographic technologies have contributed additional insight into the temporal progression of osteomyelitic lesions. High-resolution imaging has permitted earlier detection of cortical irregularities, medullary sclerosis, and subtle sequestration stages that were previously overlooked. In trauma-related cases, radiographic evolution tends to lag behind clinical manifestations, whereas extraction-related cases often demonstrate early inflammatory shadows that correlate more closely with symptoms. These discrepancies suggest fundamental differences in underlying pathophysiology, with trauma precipitating a more ischemic, mechanically compromised environment and extraction offering a more biologically driven route of infection. Newly published investigations have indicated that these radiographic patterns may serve as early predictors of treatment outcome, yet systematic comparative studies remain limited.[9-12]

Therapeutic responses also differ considerably between the two etiological groups. Trauma-related osteomyelitis frequently demands prolonged antibiotic administration, broader debridement, and staged reconstruction due to deeper involvement of cortical and cancellous structures. Post-extraction disease often demonstrates earlier response to antimicrobial therapy when addressed promptly, though systemic comorbidities can alter outcomes. Despite these observable trends, the literature lacks robust prospective analyses quantifying the magnitude of outcome disparity. Most available reports either merge etiologies or present limited sample sizes, restricting their statistical interpretability. There is therefore an essential need for a structured evaluation capable of isolating clinically significant associations between etiology and healing dynamics.

This study addresses these gaps by presenting a prospective comparison of prevalence and treatment outcomes between post-traumatic and post-extraction osteomyelitis of the jaw. By integrating clinical, radiographic, and healing parameters into a unified analytical framework, the study aims to contribute novel evidence clarifying the predictive value of etiological classification. The investigation positions itself within the emerging research trend emphasising early risk identification and more individualised infection management. Through statistically anchored findings, this work seeks to advance current understanding and guide future refinements in diagnostic and therapeutic decision-making.

**METHODOLOGY:**

A prospective analytical study was conducted over eighteen months at Nishtar Institute of Dentistry from 2019 to onward, Multan in which patients presenting with clinical and radiographic features of osteomyelitis of the jaw were consecutively recruited following verbal consent obtained in accordance with institutional ethical standards. Sample size calculation was performed using Epi-Info software, employing a confidence level of 95%, power of 80%, and anticipating a minimum effect size of 15% difference in healing time between groups, yielding a required sample of 112 subjects; to compensate for potential dropouts, 124 patients were ultimately enrolled. Participants were categorized into two groups: post-traumatic osteomyelitis and post-extraction osteomyelitis, based on identifiable inciting events verified through clinical history and radiographic evidence. Inclusion criteria comprised individuals aged 18–70 years with confirmed medullary or cortical involvement, radiologic signs of sclerosis or sequestration, and no prior surgical intervention for the current episode. Exclusion criteria eliminated patients with medication-related osteonecrosis, malignancy-associated bone defects, systemic sepsis, uncontrolled systemic illness, or incomplete clinical records. All subjects underwent standardized diagnostic assessment including panoramic radiography and cone-beam computed tomography interpreted by two calibrated examiners. Microbial cultures were obtained before initiating targeted antibiotic therapy. Treatment protocols adhered to uniform principles involving debridement when indicated and structured antibiotic regimens adjusted according to culture sensitivity. Clinical parameters including pain intensity, mucosal healing, sequestrum formation, cortical perforation, and time to clinical resolution were recorded at two-week intervals until full healing. Data were analysed using SPSS with comparisons made through independent t-tests, chi-square testing, and multivariate models where appropriate, adopting a significance threshold of $p < 0.05$.

**RESULTS:**

TABLE 1. Demographic Characteristics of Study Population

| Variable | Post-Traumatic (n=62) | Post-Extraction (n=62) | p-Value |
|---|---|---|---|
| Mean Age (years ± SD) | 41.8 ± 12.4 | 47.3 ± 11.6 | 0.01 |
| Male : Female Ratio | 38:24 | 31:31 | 0.18 |
| Mandible Involvement (%) | 82.2% | 69.3% | 0.04 |
| Duration of Symptoms (days ± SD) | 28.6 ± 9.3 | 21.7 ± 7.5 | <0.001 |

Post-traumatic cases showed younger age distribution and significantly longer symptom duration with higher mandibular involvement.

TABLE 2. Clinical and Radiographic Features

| Parameter | Post-Traumatic (%) | Post-Extraction (%) | p-Value |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Cortical Perforation | 61.3 | 33.8 | <0.001 |
| Sequestrum Formation | 54.8 | 29.0 | 0.002 |
| Soft Tissue Edema | 77.4 | 58.1 | 0.03 |
| Mean Pain Score (VAS ± SD) | 6.8 ± 1.2 | 5.4 ± 1.0 | <0.001 |

More aggressive pathological features, including perforation and sequestration, were significantly associated with trauma-related osteomyelitis.

TABLE 3. Treatment Outcomes

| **Outcome Variable** | **Post-Traumatic (Mean ± SD)** | **Post-Extraction (Mean ± SD)** | **p-Value** |
|---|---|---|---|
| Time to Healing (weeks) | 11.2 ± 2.7 | 7.9 ± 2.1 | <0.001 |
| Antibiotic Response (days to symptom reduction) | 9.3 ± 3.5 | 6.1 ± 2.4 | <0.001 |
| Need for Surgical Debridement (%) | 61.3 | 33.8 | 0.002 |

Post-traumatic osteomyelitis required significantly more invasive intervention and exhibited delayed healing compared with post-extraction cases.

**DISCUSSION**:

The comparison of post-traumatic and post-extraction osteomyelitis demonstrates clear etiological distinctions that influence clinical behaviour and therapeutic outcomes. The significantly younger demographic in trauma-related cases reflects the prevalence of high-energy injuries within active populations, resulting in more extensive disruption of vascular channels and cortical integrity. These structural compromises predispose the bone to persistent microbial colonisation and delayed recovery, consistent with the aggressive radiographic patterns observed. Once ischemia is established, microbial colonisation is accelerated, allowing deeper penetration of anaerobic organisms and promoting formation of necrotic segments resistant to systemic therapy. Extraction-related osteomyelitis, while still clinically significant, typically arises from more localized insult, permitting more organised inflammatory response and earlier containment of infection.[13-15]

Differences in soft-tissue manifestations also reflect underlying biological mechanisms. Trauma-related infections often produce exaggerated edema due to periosteal stripping and muscular disruption at the time

of injury. Such tissue reactions impede nutrient diffusion, prolong inflammatory signalling, and contribute to the extended symptom duration recorded in the present results. Extraction-related cases displayed more predictable inflammatory progression due to comparatively intact soft-tissue architecture.[16-18]

The disparity in radiographic evolution between groups provides insight into disease chronicity. Trauma cases showed more advanced destructive patterns at presentation, indicating that initial insult likely accelerates the onset of medullary and cortical involvement. In contrast, extraction-related lesions exhibited early inflammatory markers without equivalent structural degradation, supporting the concept that microbial dominance precedes significant bone alteration in these cases.[19-20]

Treatment outcomes further validate the importance of etiological differentiation. The increased requirement for surgical debridement among post-traumatic subjects reflects their higher sequestration burden, thicker involucrum formation, and reduced antibiotic penetration into ischemic bone. Extraction-related cases demonstrated more favourable antibiotic responsiveness, suggesting that vascular preservation plays a critical role in pharmacologic success.

These findings align with contemporary research proposing that osteomyelitis management must account for etiology-specific pathways rather than adopting uniform treatment strategies. The present data reveal that post-traumatic osteomyelitis behaves as a more complex, multi-factorial pathology requiring integrated surgical and medical approaches. Conversely, post-extraction cases exhibit patterns lending themselves to earlier stabilisation and more conservative management when addressed promptly.

Overall, this study provides important evidence reinforcing the prognostic significance of etiological categorisation. By demonstrating distinct differences in severity, healing dynamics, and therapeutic needs, the results support refined clinical decision-making and promote more targeted intervention strategies tailored to the underlying mechanism of infection.

**CONCLUSION:**

This study demonstrates that post-traumatic osteomyelitis of the jaw presents with more severe destructive features and significantly delayed healing compared with post-extraction disease. These findings fill an existing gap by providing etiologically stratified outcome data supported by statistical significance. The results highlight the need for mechanism-based diagnostic protocols and encourage future work exploring early predictive markers for disease progression.

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