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Research Article

Isolation and Identification of Microorganisms from Post-Extraction Dry Socket Lesions: A Clinical Study

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Received: September 07, 2026; **Published:** September 29, 2026

Abstract

Background: Dry socket (alveolar osteitis) is a common post-extraction complication characterized by pain and delayed healing. It happens when bone surfaces are exposed to the mouth, which can cause extreme pain and even infection. Microbial colonization is thought to play a role in its pathogenesis. This study investigates the relationship between oral microbial composition and dry socket incidence in tooth extraction patients.

Objective: To isolate and identify microorganisms associated with dry socket lesions.

Methods: Clinical samples were collected from 30 patients presenting with dry socket incidence. Swabs were cultured on aerobic and anaerobic medium, and isolates were identified using standard microbiological techniques.

Results: The predominant isolates included *Klebsiella* Species and *Candida albicans*, *Streptococcus viridans*, *Staphylococcus aureus*, *Streptococcus mitis, Streptococcus oralis. Pseudomonas aeruginosa* were more frequently associated with severe cases.

Conclusion: Microbial identification in dry socket lesions highlights the importance of targeted antimicrobial therapy in their management.

Keywords: *Dry Socket; Alveolar Osteitis; Oral Microbiology; Bacterial Isolation; Postoperative Infection*

Introduction

Dry socket, also known as alveolar osteitis, is one of the most common postoperative complications following tooth extraction. It is characterized by severe pain, foul odour, and delayed healing, typically occurring within 2 - 4 days after extraction. Pain in the tooth socket typically intensifying on the second or third day after extraction, often accompanied by delayed healing. After tooth extraction, healthy individuals recover quickly without severe pain, while patients who develop dry socket suffer severe pain due to direct exposure of bone to the oral environment. The most direct connection between different post-extraction manifestations is the variation in oral microbiota. The condition is most frequently associated with mandibular third molars, with reported incidence ranging from 2% to 5% in routine extractions and up to 30% in difficult or impacted cases. Despite being recognized for more than a century, the exact aetiology of dry socket remains multifactorial and incompletely understood.

Several mechanisms have been proposed to explain its pathogenesis. The most widely accepted theory involves premature fibrinolysis of the blood clot, leading to exposure of the alveolar bone and subsequent colonization by microorganisms. Local factors such as traumatic

extraction, poor oral hygiene, and smoking, as well as systemic conditions like diabetes and immunosuppression, further predispose patients to this complication. Microbial involvement has been increasingly emphasized in recent literature. Studies have demonstrated the presence of both aerobic and anaerobic bacteria in dry socket lesions, The Involved microorganisms contribute to inflammation, tissue necrosis, and delayed healing, thereby complicating the postoperative course.

Understanding the microbial profile of dry socket is essential for guiding antimicrobial therapy and improving patient outcomes. While empirical antibiotics are often prescribed, culture-based identification provides valuable insights into resistance patterns and helps tailor treatment strategies. Moreover, the study of microbial flora in dry socket lesions contributes to broader knowledge of oral microbiology and its role in postoperative infections.

Aim of the Study

The present study was undertaken to isolate and identify microorganisms associated with dry socket lesions, with the aim of correlating microbial findings to clinical presentation and highlighting their significance in management.

Materials and Methods

This was a prospective clinical study conducted in the Department of Oral and Maxillofacial Surgery over a period of six months at Our Dental College and Hospital. The study aimed to isolate and identify microorganisms associated with dry socket lesions following routine tooth extraction. Ethical clearance was obtained from the Institutional Review Board and Ethical Committee, and informed consent was secured from all participants prior to sample collection. 30 patients with the incidence of dry socket after extraction was included in the study. The inclusion criteria were patients aged between 18 and 60 years, patients clinically diagnosed with dry socket (alveolar osteitis) characterized by Severe postoperative pain within 2 - 4 days after extraction, partial or complete loss of blood clot, exposed bone in the socket. The patients with systemic conditions affecting wound healing (e.g. uncontrolled diabetes mellitus, immunocompromised states, acute odontogenic infections at the time of extraction, patients undergoing radiotherapy or chemotherapy, pregnant or lactating women (to avoid hormonal bias) were excluded.

Sample collection: The extraction socket was gently isolated using sterile cotton rolls, and superficial debris was carefully removed without disturbing the deeper socket contents. No irrigation was performed prior to sample collection to avoid dilution of microorganisms. A sterile cotton swab or sterile curette, for deeper sampling was inserted into the depth of the socket and rotated gently to collect material from the exposed bone and socket walls. Each swab was immediately placed into transport medium and delivered to the microbiology laboratory within one hour of collection.

Culture techniques and identification of isolates: The culture swabs were incubated in Peptone Water (Aerobic microbial pathogens) and Brain Heart Infusion Broth (Anaerobic Microbial pathogens) for 24 hrs. Samples were inoculated on blood agar and MacConkey agar plates and incubated at 37°C for 24 - 48 hours for aerobic culture. Samples were inoculated on anaerobic blood agar and incubated in an anaerobic jar using GasPak systems for 48 - 72 hours. For Fungal culture samples were inoculated on Sabouraud's dextrose agar and incubated at 25°C for up to 7 days. Gram staining and lactophenol cotton blue staining were done for all the samples to identify the organisms. The Biochemical tests including Catalase, coagulase, sugar fermentation, and other standard assays were done to identify the microorganisms.

Results

A total of 30 patients clinically diagnosed with dry socket (alveolar osteitis) were included in the study. The mean age of the study population was 40.4 ± 9.3 years (range: 17 - 55 years). The majority of the participants were male (22/30, 73.3%), while 8 (26.7%) were female, giving a male-to-female ratio of approximately 2.8:1.

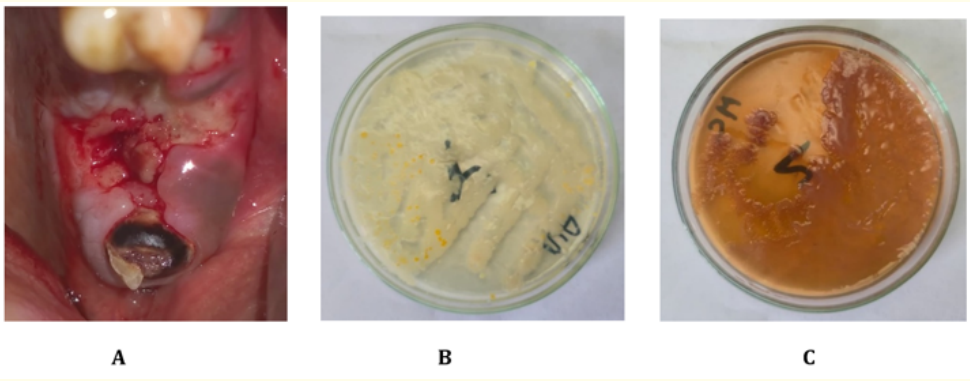

Figure 1: *A) Clinical image of dry socket in sample 2, B) Growth in nutrient agar, C) Growth in Mckonkey agar.*

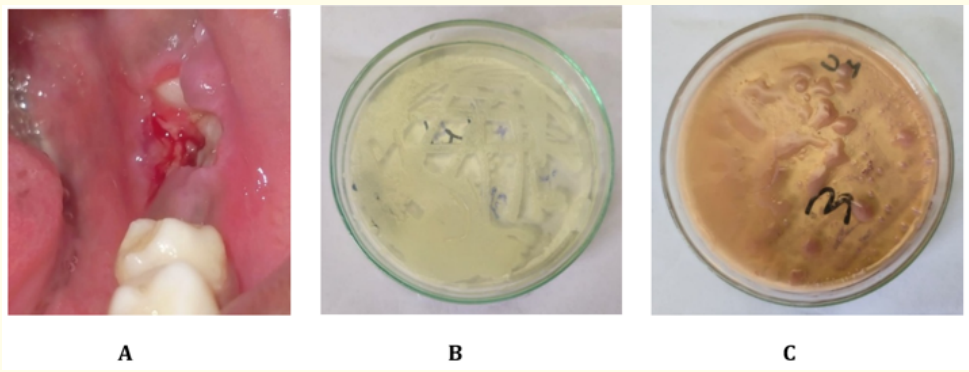

Figure 2: *A) Clinical image of dry socket in sample 3, B) Growth in nutrient agar, C) Growth in Mckonkey agar.*

The onset of symptoms occurred predominantly between the 5th and 6th postoperative days. The mean postoperative day (POD) of symptom onset was 5.47 ± 0.68 days, with 14 patients (46.7%) presenting on postoperative day 5, 10 patients (33.3%) on day 6, 5 patients (16.7%) on day 7, and 1 patient (3.3%) on day 4. Pain severity, assessed using a numerical pain score, ranged from 4 to 6, with a mean pain score of 4.73 ± 0.69. A pain score of 4 was observed in 13 patients (43.3%), 5 in 12 patients (40.0%), and 6 in 5 patients (16.7%).

Clinically, all 30 patients (100%) demonstrated absence of the blood clot and exposed alveolar bone, confirming the diagnosis of dry socket. Swab specimens were collected from all extraction sockets under aseptic conditions for microbiological culture.

On nutrient agar, bacterial or fungal growth was observed in 21 (70.0%) samples, whereas 9 (30.0%) samples showed no growth. *Staphylococcus aureus* was the most frequently isolated organism on nutrient agar, detected in 16 samples (53.3%). *Pseudomonas aeruginosa* was isolated from 5 samples (16.7%), while *Candida albicans* was identified in 4 samples (13.3%). Four specimens demonstrated mixed growth of *Candida albicans* and *Staphylococcus aureus*, indicating polymicrobial colonization.

On MacConkey agar, microbial growth was detected in 24 (80.0%) samples, while 6 (20.0%) samples demonstrated no bacterial growth. *Klebsiella* species were the predominant isolates, recovered from 22 samples (73.3%), followed by *Pseudomonas aeruginosa* in 2 samples (6.7%).

When the findings from both culture media were combined, *Klebsiella* species emerged as the most frequently isolated microorganism, being identified in 22 patients (73.3%). *Staphylococcus aureus* was isolated in 16 patients (53.3%), *Pseudomonas aeruginosa* in 7 patients (23.3%), and *Candida albicans* in 4 patients (13.3%). Three patients (10.0%) demonstrated no microbial growth on either culture medium. Mixed microbial growth was observed in several specimens, suggesting that dry socket lesions frequently harbor polymicrobial flora.

Overall, the microbiological findings indicated a predominance of Gram-negative bacilli, particularly *Klebsiella* species, followed by *Staphylococcus aureus*. Opportunistic pathogens such as *Pseudomonas aeruginosa* and *Candida albicans* were isolated less frequently. These results suggest that post-extraction dry socket lesions in the present study exhibited a diverse microbial profile with evidence of mixed bacterial colonization.

Variable	Mean ± SD	Range
Age (years)	39.93 ± 9.38	17-55
Postoperative day of symptom onset	5.63 ± 0.81	4-7
Pain score	4.70 ± 0.70	4-6

Table 1

Characteristic	n (%)	95% CI (%)
Male	23 (76.7)	61.7-91.7
Female	7 (23.3)	8.3-38.3

Table 2

Variable	n (%)	95% CI (%)
Blood clot absent	30 (100)	88.4-100
Exposed bone present	30 (100)	88.4-100
Swab sample collected	30 (100)	88.4-100

Table 3

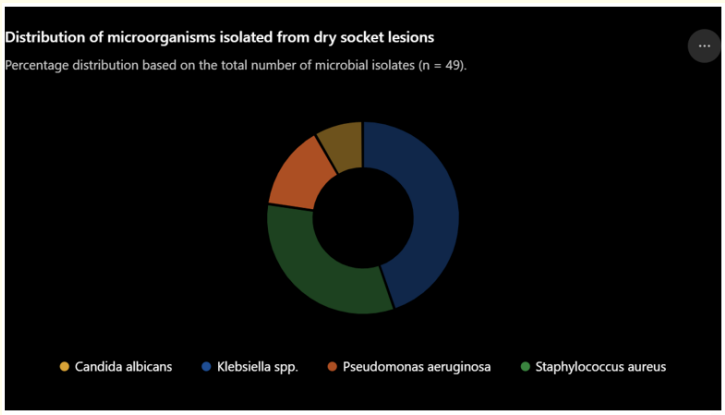

Figure 3: *Pie chart illustrating the distribution of microorganisms isolated from post-extraction dry socket lesions.*

Klebsiella spp. constituted the largest proportion of isolates (44.9%), followed by Staphylococcus aureus (32.7%), Pseudomonas aeruginosa (14.3%), and Candida albicans (8.2%).

Discussion

Dry socket (alveolar osteitis) is a common postoperative complication characterized by severe pain, loss of the blood clot, and exposed alveolar bone. Microbial colonization has been implicated in its pathogenesis through the promotion of inflammation and delayed wound healing. In the present study, 30 patients with clinically diagnosed dry socket were evaluated. The mean age was 40.4 ± 9.3 years, with a male predominance (73.3%). Symptoms developed predominantly on the 5^{th} to 6^{th} postoperative day, and the mean pain score was 4.73 ± 0.69, consistent with the typical clinical presentation of dry socket.

Microbiological analysis revealed *Klebsiella* spp. (73.3%) as the most frequently isolated organism, followed by *Staphylococcus aureus* (53.3%), *Pseudomonas aeruginosa* (23.3%), and *Candida albicans* (13.3%). Mixed microbial growth was observed in several samples, indicating the polymicrobial nature of dry socket lesions. The predominance of *Klebsiella* spp. differs from many published studies, which commonly report anaerobic bacteria such as *Fusobacterium* and *Prevotella* as the principal pathogens. This difference is likely due to the use of conventional aerobic culture techniques (nutrient agar and MacConkey agar), which do not recover strict anaerobes. Geographic variation, oral hygiene practices, and prior antibiotic exposure may also have influenced the microbial profile.

The isolation of *Pseudomonas aeruginosa* and *Candida albicans* suggests opportunistic colonization of the exposed extraction socket rather than a primary etiological role. Additionally, 10% of samples showed no microbial growth, possibly due to prior antibiotic use, low bacterial load, or the presence of fastidious or anaerobic organisms. Overall, the findings indicate that dry socket lesions harbor a diverse cultivable microbial flora, with Gram-negative bacteria predominating in this study population. Further studies using anaerobic culture and molecular techniques are recommended to better characterize the microbiology of alveolar osteitis [1-11].

Conclusion

The present study evaluated the microbiological profile of dry socket lesions using conventional culture techniques. *Klebsiella* spp. was the most frequently isolated organism, followed by *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Candida albicans*, indicating a polymicrobial microbial profile.

The findings suggest that conventional culture methods can identify cultivable microorganisms associated with dry socket; however, advanced techniques such as anaerobic culture and molecular diagnostics are required for a more comprehensive microbial analysis. Further studies with larger sample sizes are recommended to better understand the microbiology and pathogenesis of alveolar osteitis.

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Volume 22 Issue 10 October 2026
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