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MAXILLOFACIAL MANIFESTATIONS OF TUBERCULOSIS: PATHOGENETIC BASIS AND PRINCIPLES OF DENTAL MANAGEMENT

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Abstract
Tuberculosis remains a major global health problem with a wide spectrum of clinical manifestations extending beyond pulmonary involvement. Extrapulmonary forms of tuberculosis often affect the maxillofacial region, where lesions may involve the oral mucosa, jaw bones, salivary glands, and facial soft tissues. These manifestations are frequently characterized by atypical clinical presentation, prolonged course, and resistance to conventional dental treatment, which leads to diagnostic delays and inadequate management. The present article analyzes the pathogenetic mechanisms underlying maxillofacial involvement in tuberculosis and substantiates the principles of pathogenetically based dental management. Particular attention is paid to clinical variability, diagnostic challenges, interdisciplinary collaboration, and prevention of complications. The integration of dental care into the overall tuberculosis management system is emphasized as a key factor in improving clinical outcomes and patient safety.

Keywords: Tuberculosis, maxillofacial region, oral manifestations, dental management, pathogenesis.

Introduction

Tuberculosis (TB) is one of the oldest known infectious diseases and continues to pose a serious challenge to global healthcare systems. According to international health organizations, millions of new cases are diagnosed annually, and extrapulmonary forms account for a significant proportion of the disease burden. While pulmonary tuberculosis remains the most common clinical presentation, extrapulmonary involvement is increasingly recognized, particularly in immunocompromised individuals and patients with chronic systemic conditions[1.3].

The maxillofacial region represents a diagnostically challenging site for extrapulmonary tuberculosis. Lesions in this area may mimic a wide range of dental and maxillofacial disorders, including chronic inflammatory diseases, osteomyelitis, traumatic ulcers, and even malignant neoplasms. As a result, patients often undergo prolonged symptomatic treatment without etiological clarification, leading to disease progression and increased risk of complications[2.4].

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Dentists and maxillofacial specialists are frequently the first healthcare professionals to encounter such patients. Therefore, understanding the pathogenetic background and clinical features of tuberculosis-related maxillofacial lesions is essential for early diagnosis, appropriate referral, and safe dental management.

Pathogenetic Mechanisms of Maxillofacial Involvement in Tuberculosis

The development of maxillofacial lesions in tuberculosis is primarily associated with the interaction between Mycobacterium tuberculosis and the host immune system. Infection may reach the maxillofacial region through hematogenous or lymphogenous dissemination from a primary pulmonary focus, or less commonly through direct inoculation via mucosal microtrauma[1.5].

A hallmark of tuberculosis is granulomatous inflammation, characterized by the formation of tuberculous granulomas composed of epithelioid cells, lymphocytes, and Langhans giant cells. Central caseous necrosis within these granulomas leads to progressive tissue destruction and impaired healing. In the maxillofacial region, such processes result in chronic ulcers, infiltrative lesions, and bone destruction[7.8].

Microcirculatory disturbances and tissue hypoxia further exacerbate the disease course. Reduced blood supply limits the delivery of immune cells and nutrients necessary for tissue repair. In addition, immune dysregulation—particularly impaired cell-mediated immunity—facilitates persistence of the pathogen and chronicity of inflammation[5.6].

These pathogenetic features explain why tuberculosis-related maxillofacial lesions often demonstrate poor response to standard dental therapies and require a fundamentally different clinical approach.

Clinical Spectrum of Maxillofacial Tuberculosis

Maxillofacial tuberculosis demonstrates a broad and heterogeneous clinical spectrum, reflecting the complex interaction between Mycobacterium tuberculosis, host immune response, and local tissue conditions. One of the most frequently encountered manifestations in dental practice involves lesions of the oral mucosa. These lesions typically present as chronic, non-healing ulcers with irregular, undermined margins and a granulating or necrotic base. The surrounding mucosa may appear indurated, pale, or mildly erythematous. Pain is often minimal or absent, which contrasts with the severity of tissue destruction and contributes to delayed patient presentation and underestimation of the lesion's clinical significance[10.12].

In some cases, mucosal lesions may evolve slowly over weeks or months, showing little tendency toward spontaneous healing despite standard local therapy. Such ulcers are commonly localized on the tongue, gingiva, palate, or buccal mucosa, areas prone to microtrauma that may facilitate mycobacterial inoculation. The absence of acute inflammatory signs often leads clinicians to misinterpret these lesions as traumatic or inflammatory in origin.

Tuberculous involvement of the jaw bones, although less frequent, is of particular clinical importance due to its destructive nature. Osseous tuberculosis of the mandible or maxilla usually manifests as chronic osteomyelitis with an indolent course. Clinical features may include mild swelling, loosening of teeth, fistula formation, and progressive bone destruction without pronounced pain or systemic inflammatory response. Radiographic findings are typically nonspecific and may reveal areas of

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osteolysis, sequestration, or irregular bone margins, often resembling bacterial osteomyelitis, cystic lesions, or malignant tumors.

Salivary gland involvement, especially affecting the parotid gland, represents another diagnostic challenge. Tuberculous sialadenitis often presents as a painless, slowly enlarging mass that closely mimics benign or malignant salivary gland neoplasms. In such cases, absence of pain and systemic symptoms frequently delays further investigation. Regional lymphadenitis is a common accompanying feature and may precede or accompany oral and maxillofacial lesions. Affected lymph nodes are typically firm, minimally tender, and prone to caseous necrosis and fistulization in advanced stages.

The polymorphic, often subtle, and slowly progressive nature of these manifestations highlights the critical importance of careful clinical evaluation, comprehensive history taking, and a high index of suspicion for tuberculosis in patients with atypical or persistent maxillofacial lesions.

Diagnosing maxillofacial tuberculosis in dental practice is particularly challenging due to its ability to closely imitate a wide range of common dental and maxillofacial conditions. Chronic oral ulcers may be mistakenly diagnosed as traumatic lesions, aphthous stomatitis, or autoimmune mucosal disorders, especially when pain is minimal and systemic symptoms are absent. Similarly, bone involvement is frequently misinterpreted as nonspecific bacterial osteomyelitis, odontogenic infections, or neoplastic processes, leading to prolonged ineffective treatment.

Routine dental diagnostic methods, including clinical examination and conventional radiography, are often insufficient to establish a definitive diagnosis. The lack of pathognomonic clinical or radiographic features further complicates early recognition. As a result, patients may undergo repeated dental procedures, including extractions or surgical interventions, which not only fail to improve the condition but may exacerbate tissue damage and facilitate disease progression.

Definitive diagnosis requires a combination of histopathological examination, microbiological studies, and close collaboration with tuberculosis specialists. Biopsy of suspicious lesions plays a central role, revealing characteristic granulomatous inflammation with caseous necrosis. Microbiological confirmation, although technically challenging, remains essential for etiological verification. Failure to recognize the tuberculous nature of maxillofacial lesions may result in inappropriate treatment, delayed initiation of anti-tuberculosis therapy, and increased risk of disease transmission within healthcare settings.

Therefore, dentists must adopt a systematic diagnostic approach, particularly when encountering lesions that are atypical in appearance, persistent in nature, or unresponsive to conventional dental therapy. Awareness of tuberculosis as a potential underlying cause is crucial for timely referral and appropriate management.

Dental management of patients with tuberculosis-related maxillofacial lesions should be fundamentally guided by pathogenetic principles rather than limited to local symptomatic treatment. The primary objective is to ensure safe and supportive dental care while avoiding interventions that could aggravate the underlying infectious process or compromise systemic disease control.

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Table 1. Comparison of Traditional and Pathogenetically Based Dental Approaches in Maxillofacial Tuberculosis

Aspect of management	Traditional dental approach	Pathogenetically based approach
Focus of treatment	Local symptomatic therapy	Systemic disease mechanisms
Consideration of tuberculosis activity	Usually not considered	Mandatory assessment
Invasiveness of procedures	Often excessive	Minimally invasive
Healing outcomes	Delayed or unstable	More predictable
Risk of complications	Higher	Reduced
Diagnostic contribution	Limited	Facilitates early detection

Invasive dental procedures should be minimized, especially during active stages of tuberculosis. Any necessary intervention must be carefully justified and planned in close coordination with a tuberculosis specialist. Aggressive surgical approaches, extensive debridement, or unnecessary extractions may provoke exacerbation of granulomatous inflammation and delay healing. Instead, priority should be given to conservative measures that preserve tissue integrity and support natural reparative processes.

Local dental treatment should focus on maintaining oral hygiene, reducing secondary microbial contamination, and alleviating discomfort without masking disease progression. Gentle antiseptic measures and supportive care are preferable to prolonged or aggressive local therapy. Importantly, dental interventions should always be synchronized with systemic anti-tuberculosis therapy, which remains the cornerstone of effective treatment.

An interdisciplinary management strategy, involving dentists, maxillofacial surgeons, and tuberculosis specialists, is essential for optimizing outcomes. Such collaboration ensures that dental care is integrated into the overall treatment plan, reduces the risk of complications, and promotes favorable healing conditions. Adherence to pathogenetically based principles not only improves clinical outcomes but also enhances patient safety and contributes to early detection of extrapulmonary tuberculosis.

Discussion

The analysis presented in this article clearly demonstrates the necessity of re-evaluating traditional dental approaches to maxillofacial lesions in the context of tuberculosis. Conventional dental treatment protocols are primarily designed for nonspecific inflammatory or odontogenic conditions and therefore focus on local symptomatic management. However, tuberculosis is a systemic infectious disease characterized by complex pathogenetic mechanisms, including granulomatous inflammation, immune dysregulation, and impaired tissue repair. Ignoring these mechanisms inevitably limits the effectiveness of standard dental interventions.

One of the major shortcomings of traditional dental management lies in its insufficient consideration of the systemic nature of tuberculosis. Local treatment alone, even when performed correctly, cannot ensure sustained clinical improvement if the underlying infectious process remains active. In many reported cases, patients undergo repeated dental procedures, including extractions, curettage, or prolonged antiseptic therapy, without achieving lesion resolution. Such approaches may not only be

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ineffective but can also aggravate tissue destruction, delay diagnosis, and increase the risk of complications.

Another important aspect highlighted by this analysis is the diagnostic value of a pathogenetically oriented approach. Dentists who recognize the atypical clinical course, prolonged healing, and resistance to standard therapy are more likely to suspect tuberculosis at an early stage. This increases the likelihood of timely referral for specialized diagnostic procedures, including biopsy and consultation with a tuberculosis specialist, thereby facilitating early detection of extrapulmonary tuberculosis.

Interdisciplinary collaboration represents a cornerstone of pathogenetically based dental management. Close cooperation between dentists, maxillofacial surgeons, and tuberculosis specialists allows for comprehensive assessment of disease activity, appropriate timing of dental interventions, and coordination with systemic anti-tuberculosis therapy. Such collaboration not only improves safety but also optimizes clinical outcomes by aligning dental care with the overall treatment strategy.

Table 2. Clinical Benefits of Interdisciplinary Dental Management in Tuberculosis

Clinical parameter	Without interdisciplinary approach	With interdisciplinary approach
Diagnostic accuracy	Moderate	High
Time to definitive diagnosis	Prolonged	Shortened
Safety of dental interventions	Variable	Improved
Risk of disease progression	Increased	Reduced
Coordination with systemic therapy	Poor	Optimal
Overall clinical outcome	Unstable	Favorable

From a clinical perspective, pathogenetically based dental management shifts the focus from aggressive local intervention toward conservative, supportive, and strategically timed care. This paradigm reduces unnecessary trauma, preserves tissue integrity, and creates favorable conditions for healing. Moreover, it contributes to improved patient compliance and confidence, as patients receive consistent and coordinated care across medical specialties.

Overall, the findings support the integration of pathogenetically based principles into routine dental practice, particularly in regions with a high prevalence of tuberculosis. Such integration has the potential to reduce diagnostic delays, prevent complications, and enhance the role of dental professionals in the early identification of extrapulmonary tuberculosis.

Conclusion

Maxillofacial manifestations of tuberculosis represent a significant diagnostic and therapeutic challenge in dental practice. Their polymorphic presentation and chronic course demand a high level of clinical vigilance and a comprehensive understanding of disease pathogenesis.

Pathogenetically based dental management, integrated into the overall tuberculosis treatment framework, is essential for preventing complications, ensuring patient safety, and improving long-term outcomes. Continued research and education in this field are necessary to optimize dental care for patients with tuberculosis.

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