



Reimagining Infective Endocarditis: Through A Lens Beyond Orthodontics

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ABSTRACT: Infective endocarditis, a critical infection of the heart lining, poses significant risks despite diagnostic and treatment advances. Recent data underscores its complexity and advocates a comprehensive approach integrating oral health education, improved antimicrobial practices, and personalized risk assessments. This shift promises effective strategies to reduce incidence and severity, transforming cardiovascular health management. Key orthodontic procedures such as expander removal, separator placement, and band placement are clinically significant. Elective invasive procedures that could cause bacteraemia should be avoided due to limited evidence and ethical considerations. Therefore, a thorough review of existing literature is essential for informed decisions. Clinical implications stress assessing infective endocarditis risk by following current guidelines and consulting cardiologists. Minimizing procedures with injury or bacteraemia risks and promoting oral hygiene to reduce inflammation related bacteraemia are recommended. This article offers a new perspective, moving beyond traditional risk factors like orthodontic treatments to explore wider implications and prevention strategies.

Keywords: Infective endocarditis, Orthodontist, Antibiotic Prophylaxis, Bacteremia, Gingivitis

I. INTRODUCTION:

Infective endocarditis is a relatively uncommon but serious inflammation of the endocardium, the inner lining of the heart chambers and valves.¹ Oral pathogens play a significant role

in the development of infective endocarditis, as they can enter the bloodstream during normal physiological processes or dental procedures.² In recent years, various professional societies worldwide have issued guidelines on preventing infective endocarditis, reflecting differing interpretations of available evidence. This has resulted in confusing recommendations for both patients with heart conditions and clinicians.³ The development of infective endocarditis involves factors that facilitate microorganisms adhering to the heart's endothelium, triggering inflammation.⁴ Heart diseases, whether congenital or acquired, can compromise endothelial integrity, thereby increasing the risk of infective endocarditis.⁵ Endothelial damage allows for the formation of platelet-derived thrombi, which in turn facilitate inflammatory processes. Non-bacterial endocarditis precedes microbial adhesion, typically initiated when microorganisms from transient bacteremia enter the bloodstream through breaches in the skin or mucous membranes. Gram-positive bacteria, such as Staphylococcus, Streptococcus, and Enterococcus species, are responsible for up to 90% of infective endocarditis cases, with Staphylococcus aureus particularly prevalent in high-income countries.⁶ Coagulase-negative Staphylococcus species such as S. epidermidis, which are common skin commensals, contribute to around 10% of infective endocarditis cases. In contrast, infections caused by streptococci from the oral viridans group like S. mutans, S. mitis, and S. sanguinis, constitute nearly 20% of cases.⁷ Thus, a more thorough evaluation of the oral cavity as a



reservoir for bacteria is crucial. The oral microbiome consists of over 700 different species of bacteria, including commensals and opportunistic pathogens. Some of these bacteria form complex biofilms that can enter the bloodstream following disruptions in mucosal or gingival barriers.⁸

This highlights the oral cavity as a significant source of microorganisms capable of causing bacteremia and subsequent infective endocarditis. Traumatic injuries to the mucosa or gingiva during activities like chewing food or maintaining oral hygiene, as well as conditions such as dental caries or periodontitis and their associated complications, and therapeutic interventions for their prevention and treatment, can lead to the transfer of bacterial pathogens from the oral cavity into the bloodstream.⁹ This underscores the potential for bacteremia originating from oral sources, which can trigger infective endocarditis. Bacterial adhesion to disrupted endothelial walls and subsequent thrombotic formations are facilitated by specific virulence factors and surface components in various microbial species. In this manner, several species of streptococci, staphylococci and enterococci can colonize impaired endocardium and cause infective endocarditis.¹⁰ In the realm of managing endocarditis, orthodontics offers a distinctive perspective that blends precision with patient safety. The focus ranges from protocols for assessing risks aligned with current medical standards to tailored treatment approaches, all aimed at optimizing care while minimizing potential risks associated with orthodontic procedures. This comprehensive approach ensures that both healthcare providers and patients gain a clearer understanding of how orthodontics contributes to the holistic management of endocarditis.¹¹ This knowledge promotes informed decision-making and improves clinical outcomes. Infective endocarditis is a severe infection primarily affecting the endothelial surfaces of heart valves, often caused by bacteria that are normally present in the oral cavity. Routine dental procedures, including non-surgical ones, can lead to bacteremia with these oral bacteria, posing a rare but potentially serious risk during dental treatments.¹² Infective endocarditis linked with orthodontic procedures is uncommon. Regrettably, numerous orthodontic practitioners avoid treating patients who may be at risk of developing endocarditis due to the absence of clear guidelines and concerns about triggering an infection. Moreover, many patients undergoing orthodontic treatment receive unnecessary antibiotic

prescriptions for procedures with minimal risk of causing bacteremia.¹³ To prevent legal issues, orthodontists and other dental professionals must maintain precise dental records, conduct thorough and regularly updated medical histories, and adhere strictly to national guidelines concerning antibiotic prophylaxis. This article explores crucial insights and considerations from an orthodontic perspective, highlighting the link between bacteremia triggered by dental procedures and its role as a precursor to infective endocarditis, particularly in patients at higher risk, integrating clinical evidence and guidelines to ensure optimal patient care and safety.¹⁴

II. DISCUSSION:

Reimagining infective endocarditis involves transcending traditional boundaries to understand its multifactorial etiology and management.¹⁵ While orthodontic procedures and dental interventions are relevant considerations, a comprehensive approach includes broader perspectives—from epidemiology, diagnostics, and treatment paradigms to prevention strategies. Despite the lack of definitive identification of specific orthodontic procedures leading to bacteremia and subsequent infective endocarditis, orthodontics is widely practiced in Europe and the United States. Reported cases of infective endocarditis following orthodontic procedures are rare, suggesting a generally low risk. Embracing innovation, collaboration, and patient-centered care can optimize outcomes for those affected by infective endocarditis, aiming to minimize its burden in the future.¹⁶ However; the precise orthodontic procedures contributing to this risk are not clearly defined. Research suggests that placing orthodontic bands can induce bacteremia, with varying rates of detection possibly influenced by detection method challenges or variability in post-procedure occurrences.¹⁷ Moreover, procedures like teeth cleaning and polishing have been linked to bacteremia and an increased infective endocarditis risk, necessitating antibiotic prophylaxis for vulnerable patients undergoing band placement, removal, and dental polishing.¹⁸ Nonetheless, adjusting fixed or removable orthodontic appliances has not shown significant bacteremia risk or documented infective endocarditis cases. Consequently, current American Heart Association guidelines do not recommend prophylaxis for orthodontic appliance adjustments. Similarly, taking impressions for study models poses minimal risk of bacteremia and does not necessitate prophylactic antibiotics.¹⁹ In contrast, surgically exposing teeth, particularly palatal canines, is



acknowledged for its potential to induce bacteremia. Hence, susceptible patients at risk of infective endocarditis are advised to receive prophylactic antibiotics before this procedure.²⁰ Following surgical exposure, management of the surgical site typically follows protocols akin to those used for extraction sites or erupting teeth, often without ongoing antibiotic coverage.²¹ The debate surrounding the method of traction following surgical exposure in orthodontic procedures hinges on the potential risk of bacteremia. Advocates contend that techniques involving replaced flap procedures may elevate this risk compared to methods like excisional exposure.²² This perspective posits that the manipulation and repositioning of gingival tissues during replaced flap techniques could introduce bacteria into the bloodstream more readily.²³ Conversely, an opposing viewpoint suggests that tooth movement facilitated by a replaced flap procedure mimics natural tooth eruption, which might not necessarily require prophylactic antibiotics.²⁴ This argument draws parallels between the physiological processes of accelerated tooth movement and routine dental changes, potentially minimizing the perceived need for antibiotic prophylaxis.²⁵ However, beyond the debate over antibiotics, prophylactic principles in orthodontics encompass broader strategies. These include promoting and maintaining good oral hygiene practices to mitigate the risk of oral diseases that could lead to bacteremia.²⁶ Strategies such as regular dental cleanings, effective plaque control, and patient education on oral health play crucial roles in preventing the conditions that could predispose individuals to bacteremia and subsequent complications like infective endocarditis.²⁷ Thus, while the controversy persists regarding the optimal traction method and its associated bacteremia risk, a comprehensive approach to prophylactic care in orthodontics integrates considerations of both antibiotic use and broader oral hygiene strategies.²⁸ This approach aims to optimize patient safety and minimize potential risks associated with orthodontic procedures. Inadequate oral hygiene fosters plaque accumulation, increasing bacterial quantities and heightening the risk of bacteremia and infective endocarditis.²⁹ Subsequent gingival inflammation and bleeding from broken capillaries can induce transient bacteremia. Thus, placing orthodontic appliances in the presence of gingival inflammation may elevate bacteremic episodes.³⁰ Even individuals with clinically healthy gums can experience transient bacteremia during activities like tooth brushing when inflammation and plaque

are present. However, maintaining scrupulous oral hygiene significantly mitigates the bacteremia load.³¹ Silver et al. noted an increase in the percentage of positive cultures, indicating isolated microorganisms, correlating with the severity of inflammation. Their review aimed to explore the relationship between orthodontic procedures and infective endocarditis, offering practical advice to healthcare providers. However, the connection between orthodontics and infective endocarditis remains incompletely understood, with no reported cases of infective endocarditis specifically caused by routine oral hygiene procedures in patients with healthy gingiva.³² Furthermore, there are no reports of infective endocarditis triggered by oral hygiene practices in individuals with good gingival health. The quantity of microorganisms in bacteremia is also influenced by the degree of trauma following specific manipulative procedures. Therefore, antibiotic prophylaxis is recommended for some procedures but not universally.³³

An effective strategy to reduce bacteremia levels involves using an oral rinse containing 0.2% (w/v) chlorhexidine solution. Multiple applications of chlorhexidine have not been found to decrease its effectiveness as a disinfectant.³⁴ This differs from patients who have undergone prolonged courses of antibiotics, potentially harbouring resistant strains of oral streptococci commonly associated with bacterial endocarditis. Patients at risk of infective endocarditis are typically classified into three categories: high risk, moderate risk, and negligible risk, based on their medical history.³⁵ High-risk patients may proceed with orthodontic treatment after consultation with a cardiologist to assess risks. If the cardiologist determines a high risk of infective endocarditis, orthodontic treatment should be avoided. Moderate-risk patients can undergo orthodontic procedures but require antibiotic prophylaxis for procedures inducing bacteremia.³⁶ Patients at negligible risk generally do not need antibiotic prophylaxis for orthodontic treatment, although it is advisable to consult a physician to confirm their medical status beforehand. Many prospective orthodontic patients report a history of a heart murmur, necessitating investigation to determine whether it commenced before treatment initiation. Antibiotic prophylaxis is recommended for patients classified as 'high' or 'moderate' risk but not for those in the 'negligible' risk category.³⁷ This category includes cardiac conditions where the risk of developing endocarditis is not elevated compared to the general population. The British Society of Antimicrobial Chemotherapy identifies a subset of patients with endocardial disease termed 'special



risk', which are especially susceptible to infective endocarditis.³⁸ Before initiating orthodontic treatment, it is essential to thoroughly understand the patient's medical history and current condition. This often involves additional assessments such as echocardiography performed by a cardiologist to assess the status of heart valves and the risk of infective endocarditis. Obtaining informed consent from the patient or their guardian is crucial.³⁹

This ensures that the patient understands the risks associated with orthodontic treatment and any necessary precautions due to their medical condition. For patients at high risk of infective endocarditis, treatment plans should be practical and achievable, avoiding procedures that could potentially introduce excessive bacteremia.⁴⁰ This may mean opting for less invasive treatment approaches or spacing out appointments to minimize the risk of bacterial exposure. Maintaining impeccable oral hygiene is critical for all orthodontic patients, but it is particularly crucial for those at risk of infective endocarditis. Good oral hygiene reduces plaque buildup, which in turn lowers the risk of bacteremia during orthodontic procedures. Patients categorized as 'high' or 'moderate' risk for infective endocarditis should receive prophylactic antibiotics before orthodontic procedures that are known to induce bacteremia. This is to prevent bacteria from entering the bloodstream and potentially causing infection in the heart valves or other prosthetic materials.⁴¹ Prior to any orthodontic procedure in high-risk patients, a preliminary rinse with 0.2% chlorhexidine mouthwash is recommended. This helps reduce the bacterial load in the oral cavity, further minimizing the risk of bacteremia. If orthodontic appliances cause mucosal irritation and subsequent bleeding, daily rinsing with chlorhexidine mouthwash is advised.⁴² This helps maintain oral hygiene and reduces the risk of bacterial entry through compromised mucosal surfaces. For optimal prevention, antibiotics should ideally be given within 2 hours prior to the procedure. To minimize the necessity for multiple preventive treatments, fixed appliances should be placed in a single visit whenever possible. This protocol aims to enhance patient safety and lower the risk of infective endocarditis associated with orthodontic treatment, in line with current prophylactic guidelines. In all risk categories (high, moderate, negligible), orthodontic procedures such as banding or bracket bonding should ideally be performed without any interruption, or preferably with bonding applied to all teeth.⁴³

Patients should be instructed to promptly report any unexplained illness following the

procedure. Despite appropriate antibiotic prophylaxis, infective endocarditis can still occur, with the highest risk typically within the first 30 days after the procedure.⁴⁴ Therefore, clinicians must maintain vigilance throughout the prolonged course of orthodontic treatment. Antibiotic management protocols specify that Clindamycin tablets should be taken with a full glass of water to prevent esophageal irritation. Children under 10 years should receive half the adult dose of amoxicillin or clindamycin, while those under 5 years should receive a quarter of the adult dose.⁴⁵ For children under 10 years, vancomycin at 20 mg and gentamicin at 2 mg are recommended. Children under 14 years should be given teicoplanin at 6 mg/kg plus gentamicin at 2 mg/kg. In patients not at special risk, amoxicillin may be administered twice within one month, as a single 3-g dose is unlikely to promote the growth of clinically significant amoxicillin-resistant strains. A third dose should be deferred until at least one month later. Clindamycin can be used again for prophylaxis after an interval of at least two weeks. These guidelines aim to optimize antibiotic use for prophylaxis while minimizing the risk of complications in orthodontic patients vulnerable to infective endocarditis.⁴⁶

Future Directions: Innovations and Challenges Ahead

Looking ahead, ongoing research endeavours seek to address unresolved challenges in the prevention, diagnosis, and treatment of IE. Advances in microbial genomics, immunotherapy, and bioengineering hold promise for personalized medicine approaches tailored to individual patient profiles. However, challenges such as antimicrobial resistance, healthcare disparities, and access to specialized care underscore the need for concerted efforts across disciplines and healthcare systems.⁴⁷

III. CONCLUSION:

Orthodontic treatment's potential link to infective endocarditis lacks direct evidence due to ethical constraints. Decisions hinge on thorough literature reviews. Clinical guidance stresses pre-treatment evaluation of cardiac patients for endocarditis risk via American Heart Association guidelines and cardiologist input. Minimizing tissue trauma and maintaining excellent oral hygiene are crucial preventive measures. While cases of endocarditis from orthodontics are rare, guidelines categorize patients into high, moderate, and low-risk groups. High-risk patients need physician consultation before treatment, while moderate-risk may consider antibiotic prophylaxis for high-risk procedures. Low-risk patients



generally don't require antibiotics but should use chlorhexidine mouthwash before adjustments to reduce bacteremia risk.

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