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Dental procedures in people living with HIV: a narrative review

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Abstract

HIV affects over 39 million people globally and remains a challenge in oral health care despite advances in antiretroviral therapy (ART). The oral cavity often reflects immune status and serves as a site for opportunistic infections, making dental care essential in HIV management. This review explores four main aspects of dental care for people living with HIV (PLHIV): HIV pathophysiology, transmission risk during dental procedures, infection control strategies, and pre-treatment clinical assessment. Using the population–concept–context framework, literature was reviewed from PubMed, Scopus, and Web of Science spanning 2000-2025. Oral conditions such as candidiasis, Kaposi's sarcoma, and periodontal disease remain prevalent in PLHIV and are closely linked to HIV progression. The risk of HIV transmission in dental settings is very low (< 0.3% for percutaneous exposure) when standard precautions are followed, though stigma among providers persists. Effective infection control includes personal protective equipment, sterilization, and aerosol reduction. Pre-procedural evaluation (CD4 count, viral load, and hematological status) is vital for safe care. In cases of neutropenia, antibiotic prophylaxis may be needed, and elective procedures should be deferred. Dental treatment for PLHIV is safe when guided by evidence-based protocols. Integrating infection control, risk assessment, and personalized planning strengthens the role of dentistry in comprehensive HIV care.

Keywords: *HIV. Dentist. Infection control. Antibiotic prophylaxis.*

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Introduction

HIV remains a major global health problem, with about 40.8 million people affected worldwide[1]. Antiretroviral therapy (ART) has greatly improved survival, making HIV a chronic condition[2]. People living with HIV (PLHIV) still experience systemic and oral health problems that need special attention in dentistry. The mouth is a common site of opportunistic infections and reflects immune status. Oral lesions often appear early in HIV infection and remain important in the ART era. For this reason, oral health should be fully integrated into HIV care to support diagnosis, treatment, and quality of life[3-5].

Understanding the mechanism of HIV infection is essential for dental professionals[6-8]. HIV enters through CD4 receptors and co-receptors, integrates into host cells, and spreads through the immune system. This process weakens immunity and leads to oral problems such as candidiasis, oral hairy leukoplakia, Kaposi's sarcoma, and periodontal disease. Recognizing these links helps dentists identify and manage oral signs that may indicate disease progression[3,4].

The risk of HIV transmission during dental care has often been overstated, causing stigma and fear. In reality, the risk of occupational transmission is very low, especially when standard precautions are followed. The main risks are needlestick injuries and direct contact with blood or saliva containing blood, while no evidence supports aerosol transmission. Correct understanding of these risks is critical to reduce stigma and ensure PLHIV receive equal access to care[9-11].

Infection control protocols are the foundation of safe practice in dentistry. Use of protective equipment, instrument sterilization, and surface disinfection are proven to prevent cross-infection. Recent improvements, such as high-volume suction and better ventilation, further reduce risks. These measures protect both dental workers and immunocompromised patients, making infection control a dual responsibility in HIV care[9-13]. Dental management of PLHIV should be based on knowledge of HIV biology, real transmission risks, strict infection control, and individualized assessment[6,14,15]. This review brings together current evidence to guide dental professionals in providing safe, effective, and equitable care for PLHIV.

Methods

This narrative review was conducted to synthesize current evidence on dental and oral care for PLHIV. The review was guided by the population–concept–context (PCC) framework, which is recommended for structuring research questions (RQ) in narrative and scoping reviews. The methodological process involved four stages: (i) formulation of RQs, (ii) application of the PCC framework, (iii) structured literature search, and (iv) data extraction and narrative synthesis[16] (Table 1).

Search strategy

A structured search was carried out in PubMed/MEDLINE, Scopus, and Web of Science. The search strategy combined controlled vocabulary (MeSH terms) and free-text keywords derived from the PCC framework. Boolean operators (AND, OR) were used to refine searches. The time frame was restricted to publications from 2000 to 2025, with inclusion of peer-reviewed articles, systematic reviews, and international guidelines (e.g., World Health Organization, Centers for Disease Control and Prevention).

Data extraction and narrative synthesis

Eligible studies were screened for relevance to at least one of the four RQs. Data extraction focused on study type, population characteristics, clinical context, interventions or recommendations, and key findings. Evidence was synthesized narratively by grouping results under the four RQs. Rather than pooling quantitative outcomes, the synthesis integrated findings across epidemiological, clinical, and guideline-based sources to provide a comprehensive understanding of dental care for PLHIV.

Results and discussion

Mechanism of HIV infection and oral manifestations (RQ1)

HIV infection is initiated by viral entry through gp120 interaction with the CD4 receptor and co-receptors CCR5 or CXCR4, followed by integration of viral RNA into the host genome and systemic dissemination through lymphoid tissues and mucosal sites. This progressive immunological deterioration results in CD4+ T cell depletion and chronic immune activation, thereby predisposing individuals to oral opportunistic infections[17,18]. The oral cavity is particularly affected due to its microbial complexity and constant antigen exposure. Opportunistic conditions such as oral candidiasis (OC), Kaposi's sarcoma, oral hairy leukoplakia, and necrotizing ulcerative periodontitis remain prevalent in PLHIV, especially in patients

Table 1. Formulation of RQ

RQ	Research question	Population (P)	Concept (C)	Context (C)
1	What are the biological mechanisms of HIV infection and systemic dissemination in the human body, and how do these processes contribute to oral manifestations relevant to dentistry?	PLHIV	HIV infection mechanisms, systemic dissemination, oral opportunistic infections	Clinical and oral health settings
2	What is the actual risk of HIV transmission during dental and oral care procedures, and what strategies minimize occupational and cross-infection risks?	PLHIV and dental health care workers	Risk of HIV transmission during dental/oral care	Dental clinics and oral health care settings
3	What infection control procedures, instruments, and materials are most effective in preventing cross-infection during dental care for PLHIV?	PLHIV receiving dental care	Infection control protocols, sterilization, PPE, disinfection	Dental procedures and clinical practice
4	How should dental procedures (surgical and non-surgical) be safely performed in PLHIV, including pre-procedural assessments (CD4 count, FBC, viral load, neutrophil count), and what is the role of antibiotic prophylaxis in immunocompromised patients such as those with neutropenia?	PLHIV undergoing dental procedures	Dental procedures, pre-procedural assessment, laboratory parameters (CD4, FBC, viral load, neutrophil count), antibiotic prophylaxis	Clinical dental practice

RQ: research questions; PLHIV: people living with human immunodeficiency virus; PPE: personal protective equipment; FBC: full blood count;

with advanced disease or poor adherence to ART. While the widespread use of ART has reduced the overall prevalence of such lesions, their persistence in some patients highlights residual immune dysregulation and drug-related side effects[4,19-23]. For dental practice, these manifestations serve as both diagnostic indicators and prognostic markers, reinforcing the importance of routine oral examination as part of comprehensive HIV care.

Risk of HIV transmission during dental care (RQ2)

The risk of HIV transmission in dental settings has historically been overestimated, contributing to stigma and occasional denial of treatment for PLHIV[24-28]. Empirical data demonstrate that the risk of occupational transmission following percutaneous exposure is < 0.3%, with mucous membrane exposure estimated at 0.09%. The primary risks arise from needlestick injuries and accidental contact with blood or saliva containing visible blood. Importantly, there is no evidence to support aerosol transmission in dental practice, despite the high frequency of aerosol-generating procedures[29-32]. Nevertheless, studies show that misconceptions persist among dental professionals, influencing attitudes toward HIV-positive patients[6,33]. Educational interventions and clear communication of evidence-based risks are essential to address these gaps. By emphasizing actual versus perceived risks, dentists can reduce fear-driven stigma and ensure that PLHIV receive equitable access to oral health care.

Infection control protocols (RQ3)

Effective infection control remains the cornerstone of safe dental practice. Universal precautions (use of gloves, masks, gowns, protective eyewear, and rigorous sterilization of instruments) are well-established as effective in preventing cross-infection. Autoclaving remains the gold standard for sterilization, while high-level surface disinfectants such as sodium hypochlorite and alcohol-based solutions ensure environmental decontamination. Advances in single-use disposable devices and validated sterilization monitoring systems have further enhanced safety. More recently, lessons from the COVID-19 pandemic have reinforced the need for aerosol reduction strategies, including high-volume evacuation, pre-procedural mouth rinses, and improved ventilation[34,35]. For PLHIV, infection control serves a dual purpose: protecting dental health care workers from exposure and preventing opportunistic secondary infections in immunocompromised patients. Evidence strongly supports that strict adherence to infection control protocols virtually eliminates occupational HIV transmission and ensures the safe integration of PLHIV into routine dental care[10,30,34,35].

Dental procedures and pre-procedural assessment (RQ4)

Dental procedures in PLHIV can generally be performed safely, provided that individualized pre-procedural assessment is carried out. Patients with CD4 count above 200 cells/μL and suppressed viral loads typically

respond to treatment comparably to HIV-negative individuals. Severe immunosuppression (CD4 < 200 cells/μL) or thrombocytopenia may require treatment modifications, including antibiotic prophylaxis, atraumatic surgical techniques, or postponement of elective procedures[36-39]. Surgical interventions such as extractions or periodontal surgery should be planned with careful hemostatic control, while restorative and preventive procedures can be performed across all stages of HIV disease. Recent studies also emphasize the importance of interdisciplinary collaboration, where dental professionals work closely with physicians to optimize treatment timing and adjust procedures based on the patient's systemic health status[40-42]. This integration of medical and dental care maximizes patient safety while promoting oral health as a vital component of comprehensive HIV management.

CD4 count remains a standard parameter for evaluating immune function in PLHIV limited access to laboratory-based flow cytometry in resource-constrained settings poses significant challenges. Total lymphocyte count (TLC) as a surrogate marker has been explored to improve accessibility. TLC has been shown to correlate with CD4 counts in certain populations and may serve as a practical proxy where advanced laboratory services are unavailable. These alternatives are particularly relevant in regions with high HIV prevalence and limited infrastructure, where dental professionals often serve as first-line providers[36-39]. Incorporating such accessible testing strategies into dental practice can enhance patient safety, guide treatment planning, and expand equitable access to oral healthcare for PLHIV.

Neutropenia (low neutrophil count) is a recognized complication in PLHIV, particularly among patients with advanced disease or those on certain antiretroviral or adjunctive therapies. Neutropenia increases the risk of systemic infection and can complicate wound healing after invasive dental procedures such as extractions or periodontal surgery. In these patients, prophylactic antibiotics are often recommended to reduce the risk of post-operative infection and sepsis. The decision to prescribe prophylaxis should be based on an absolute neutrophil count (ANC)[42-44] (Tables 2 and 3).

Common regimens include amoxicillin or, in penicillin-allergic patients, clindamycin. Coordination with the patient's physician is advised to align dental management with systemic treatment. Incorporating neutrophil status into pre-procedural assessment allows dental professionals to minimize complications, personalize treatment planning, and enhance safety in PLHIV[44,45].

Discussion

The synthesis of findings across these four domains underscores the importance of an integrated approach to dental care for PLHIV. Understanding the biological mechanisms of HIV infection provides insight into the persistence of oral opportunistic infections, which remain important diagnostic and prognostic indicators despite advances in ART. These manifestations reinforce the role of dentists as both clinicians and contributors to multidisciplinary HIV care[33,46,47].

PLHIV are particularly vulnerable to a wide range of oral health issues. Among the most common are dental caries, which tend to occur more frequently and with greater severity, especially in children and individuals experiencing significant immunosuppression. Periodontal disease is also prevalent, with PLHIV facing heightened risks of both typical and HIV-specific forms that often present with more aggressive symptoms. In addition, oral mucosal lesions such as candidiasis, hairy leukoplakia, and necrotizing ulcerative gingivitis are frequently observed and can act as important clinical indicators of declining immune function[3,4,48,49].

Oral dysbiosis in PLHIV

Oral dysbiosis represents a persistent and clinically relevant complication among PLHIV, characterized by microbial imbalance within the oral cavity. The progressive depletion of CD4+ T lymphocytes in HIV infection compromises mucosal immunity, thereby disrupting the homeostasis of the oral microbiome[50-52]. Although ART has significantly reduced the incidence of opportunistic oral infections, it has not fully restored microbial equilibrium. HIV-associated immune dysfunction marked by alterations in salivary enzymes, proteins, and cellular components. The imbalance between host defenses and microbial communities contributing to the pathogenesis of HIV-related oral diseases[50,51,53].

Microbial profiling studies have revealed notable shifts in oral microbiome diversity and composition among PLHIV. Bacterial α-diversity in plaque and saliva correlates with immunological markers, while lipopolysaccharide-producing bacteria associated with inflammation are enriched in individuals with severe periodontitis. Fungal diversity is also diminished in patients with a history of acquired immunodeficiency syndrome. ART regimens, particularly those involving integrase strand transfer inhibitors, influence the abundance of specific bacterial taxa such as *Streptococcus*, *Veillonella*, and *Lactobacillus*[50-52].

Table 2. Neutropenia and antibiotic prophylaxis in dental treatment of PLHIV

Absolute neutrophil count	Clinical consideration	Antibiotic prophylaxis recommendation
> 1,500 cells/μL	Normal/near-normal immune function	Prophylaxis generally not required
1,000-1,500 cells/μL	Mild neutropenia; increased infection risk with invasive procedures	Consider prophylaxis for extractions, periodontal surgery, or other invasive care

PLHIV: people living with human immunodeficiency virus.

Table 3. Dental procedures and antibiotic prophylaxis in PLHIV

Type of dental procedure	Examples	Antibiotic prophylaxis recommendation	Common regimen
Routine non-invasive procedures	Oral examination, radiographs, impressions, restorative treatments (fillings, crowns), prosthodontics (dentures)	Not required unless patient is severely immunocompromised (CD4 < 200 cells/μL or ANC < 1,000 cells/μL)	None
Preventive procedures	Supragingival scaling, polishing, fluoride application	Not required in most cases; consider prophylaxis if ANC < 1,000 cells/μL	None; if required, Amoxicillin 2 g orally, 30-60 min before procedure
Minor invasive procedures	Subgingival scaling and root planning, uncomplicated extractions	Consider prophylaxis if CD4 < 200 cells/μL or ANC 1,000-1,500 cells/μL	Amoxicillin 2 g orally, 30-60 min before; Clindamycin 600 mg if penicillin-allergic
Major surgical procedures	Surgical extractions, periodontal flap surgery, implant placement, endodontic surgery (apicoectomy), and bone surgery	Prophylaxis recommended, especially if ANC < 1,500 cells/μL or CD4 < 200 cells/μL	Amoxicillin 2 g orally (adults) or 50 mg/kg (children), 30-60 min before; Clindamycin 600 mg if allergic
High-risk situations	ANC < 1,000 cells/μL, uncontrolled viral load, systemic symptoms (fever, opportunistic infections)	Prophylaxis strongly indicated; elective surgery should be deferred until immune recovery	Amoxicillin 2 g orally, 30-60 min before; alternatives: Azithromycin 500 mg or Clarithromycin 500 mg

PLHIV: people living with human immunodeficiency virus; ANC: absolute neutrophil count.

OC in PLHIV

OC remains one of the most prevalent opportunistic fungal infections affecting PLHIV, despite the widespread implementation of ART. *Candida albicans* is the predominant etiological agent, although non-albicans species such as *Candida glabrata*, *Candida tropicalis*, and *Candida krusei* are increasingly identified in clinical isolates[54,55]. The persistence of OC in the ART era underscores its role as a clinical indicator of immunosuppression and virological failure. Epidemiological data reveal variable prevalence rates ranging from 13.4% to 41%[56,57], with significant associations observed between OC and immunological parameters, particularly CD4+ T-cell counts ≤ 200 cells/mm^3 and viral loads exceeding 10,000 copies/mL. Additional risk factors include poor oral hygiene, tobacco and alcohol use, antibiotic exposure, and advanced HIV disease stage[54,56].

Clinically, OC in PLHIV manifests in diverse forms, including pseudomembranous candidiasis, characterized by removable white plaques over erythematous mucosa, and erythematous candidiasis, presenting as flat, red lesions. Less common variants such as chronic hyperplastic candidiasis and angular cheilitis may also occur[38,58]. Diagnosis relies on clinical evaluation supported by microbiological culture and molecular identification of Candida species. Management typically involves topical antifungals (e.g., nystatin, miconazole) and systemic agents (e.g., fluconazole, itraconazole), though therapeutic challenges persist due to biofilm formation and emerging antifungal resistance[57,59].

Dental caries in PLHIV

Research consistently demonstrates that PLHIV experience a higher prevalence of dental caries

compared to HIV-negative individuals. For instance, epidemiological data from Rwanda revealed a caries rate of 50.5% among PLHIV, notably higher than the 40.5% observed in the control group[60]. In pediatric populations, caries incidence is particularly elevated and shows a significant correlation with immunological deterioration, such as reduced CD4+ lymphocyte counts and detectable viral loads[61,62]. Although ART may alleviate certain oral lesions, it does not consistently mitigate caries risk. In fact, ART has been linked to persistent or even increased caries susceptibility, potentially due to side effects like xerostomia or the sugar content in pediatric formulations[63]. Additional factors influencing caries prevalence include age, where older children and adults are more affected, and gender, with some studies identifying females as having a higher risk[61,64]. While immunologic markers such as low CD4+ counts and high viral loads are sometimes associated with increased caries risk, findings remain inconsistent across studies[3,48].

Periodontitis in PLHIV

Chronic periodontitis presents more severely in HIV-positive adults, characterized by deeper periodontal pockets and greater clinical severity, often independent of oral hygiene practices. HIV-associated periodontal conditions are estimated to affect approximately 5-12% of PLHIV. Despite the widespread use of ART, periodontitis remains highly prevalent, although necrotizing forms tend to decrease, and certain immune parameters may improve with treatment. Longitudinal studies suggest that periodontal interventions can enhance both oral health and systemic immune function over time, yet the disease frequently persists. Age is a compounding factor, with older individuals exhibiting higher rates of periodontal disease. Immunologic deterioration, particularly CD4+ counts below 200 cells/μL, is strongly linked to worsened periodontal status, as reflected in elevated community periodontal index treatment needs (CIPTN) scores. Moreover, high viral loads independently contribute to the increased prevalence of periodontal lesions, even in cases where CD4+ levels are not critically low. These findings underscore the complex interplay between HIV progression, immune suppression, and periodontal health outcomes[65-67].

The risk of occupational HIV transmission in dental practice has historically been overstated. Evidence demonstrates that when universal precautions are consistently applied, the likelihood of transmission is exceedingly low. Nevertheless, stigma and misconceptions remain common, highlighting the need for continuous education to align perception with scientific evidence[10,68].

Infection control protocols form the cornerstone of HIV dentistry. Standard measures (instrument sterilization, personal protective equipment, and disinfection) are proven to prevent cross-infection. Innovations such as high-volume suction and improved ventilation add further layers of safety. Importantly, these protocols protect both providers and patients, particularly immunocompromised individuals who may be vulnerable to secondary infections[10,68].

Pre-procedural assessment ensures that dental care is tailored to the patient's systemic condition. CD4 counts, viral loads, and hematological indices guide decisions on treatment planning and procedural modifications. In addition to these parameters, neutropenia represents a critical consideration in dental management. Reduced neutrophil counts significantly increase the risk of post-operative infections, making antibiotic prophylaxis an important preventive strategy in selected cases. Evidence-based thresholds for prophylaxis – particularly when ANC falls below 1,000 cells/μL – provide practical guidance for clinical decision-making. Integrating neutrophil status into dental assessment enables safe surgical interventions while minimizing complications[44,45,69].

Taken together, these dimensions demonstrate that dental procedures in PLHIV are both feasible and safe when grounded in evidence-based practice. By integrating mechanistic understanding, realistic risk assessment, strict infection control, and individualized pre-procedural planning, dentists can deliver care that is both safe and equitable. Such an approach enhances oral health outcomes, contributes to systemic well-being, and supports the overall quality of life for PLHIV.

Conclusion

Dental procedures for PLHIV are safe and effective when based on evidence. Oral manifestations remain key indicators of immune status, while the actual risk of transmission in dental care is minimal under strict infection control. Pre-procedural assessments, including CD4, viral load, and hematological indices, guide safe treatment planning. In cases of neutropenia, antibiotic prophylaxis and procedure modification are essential. Dentistry thus plays a key role in comprehensive HIV care, supporting both oral and systemic health.

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Conflicts of interest

None.

Ethical considerations

Protection of humans and animals. The authors declare that no experiments involving humans or animals were conducted for this research.

Confidentiality, informed consent, and ethical approval. The study does not involve patient personal data nor requires ethical approval. The SAGER guidelines do not apply.

Declaration on the use of artificial intelligence. The authors declare that no generative artificial intelligence was used in the writing of this manuscript.

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