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Stomatology: An analysis regarding oral health in HIV patients. Literature review

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ABSTRACT

Individuals living with human immunodeficiency virus (HIV) face a heightened risk of developing oral diseases. As such, antiretroviral therapies are crucial for treating HIV, as they help restore immune system functionality. Oral health issues can be not only painful and bothersome but can also lead to further complications. Therefore, the aim of this research is to conduct a thorough analysis of oral health in HIV patients, providing them with vital information and timely preventive measures. The methodology employed is descriptive analysis, which involves collecting specific data to gain a deeper understanding of oral health challenges faced by HIV patients. The findings indicate that periodontitis, gingivitis, hairy leukoplakia, and candidiasis are the most common oral conditions in these patients and may serve as early indicators of HIV/AIDS infection. Moreover, the manifestation of oral diseases can vary depending on age, genetics, endemic factors, or lifestyle choices. In summary, the emergence of oral diseases in HIV patients is influenced by a myriad of internal and external factors. Further research is essential to refine treatment strategies for HIV and associated oral diseases, ultimately improving the quality of life for immunocompromised individuals.

Keywords: HIV, AIDS, oral health, oral disease, HIV patient, oral infection

INTRODUCTION

The fight against the Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS) represents one of the most complex challenges on a global scale. According to the Pan American Health Organization (PAHO), there are around 40.4 million people infected worldwide, with 2.5 million in Latin America [1]. The same source indicates that HIV/AIDS promotes the emergence of oncological diseases such as lymphomas and Kaposi's sarcomas, among others. In addition, genetic predisposition increases comorbidity and mortality in those affected by these conditions [2]. According the World Health Organization (WHO) the main risk factors for HIV/AIDS infection include unsafe sexual practices (anal, vaginal, and oral), the presence of Sexually Transmitted Diseases (STDs), alcohol and drug consumption in sexual contexts, sharing needles and other contaminated injection materials, as well as receiving transfusions and transplants without proper guarantees and accidents with contaminated sharp material [3].

Oral infections represent some of the first signs of HIV/AIDS, affecting approximately 50% of individuals with HIV and 80% of those with AIDS [4]. These conditions can cause a decrease in mental and physical health, ulcerations, pain and inflammation, loss of taste, swallowing difficulties, and tooth loss, among other problems [5]. Antiretroviral therapy (ART) has shown promising results, not only reducing mortality and oral infections such as candidiasis, leukoplakia, salivary gland disorders, and Kaposi's sarcoma, but also improving quality of life [6,7]. However, this treatment can alter the salivary flora and oral microbiota, which in turn can lead to conditions such as xerostomia, periodontitis, and caries [8].

This study focuses on analyzing recent findings on oral health in individuals with HIV/AIDS, examining the various diseases and infections, as well as

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existing control and prevention tactics. The relevance of this research is due to the fact that, beyond facing stigma and social prejudice, patients with HIV/AIDS also suffer a decline in their quality of life due to the oral complications associated with their condition. The synthesis of current data from recent research is crucial to improve the well-being of these patients and to promote the discovery of new strategies and methods that mitigate the adverse effects of HIV/AIDS.

METHODS

The methodology of this research is based on a literature review to provide an updated analysis of oral health in patients with HIV/AIDS, respecting specific inclusion and exclusion criteria [9]. An exhaustive search was conducted in recognized databases such as PubMed, Scopus, MDPI, and Google Scholar, using key terms like "Oral health; HIV/AIDS" and "Oral infections; HIV/AIDS patients". Studies published in the last decade (2014-2024) were considered for analysis, limiting the selection to scientific articles in English and Spanish. Given the pandemic nature of HIV/AIDS, global studies were included to understand universal trends and develop control and prevention strategies applicable to various regions and cultures.

RESULTS

Figure 1 illustrates common symptoms observed in individuals with HIV, categorized as respiratory (dry cough), psychological (depression, memory disorders), dermatological (brown, red, pink skin spots), gastrointestinal (persistent diarrhea exceeding a week), oral (mouth lesions), lymphatic (swollen lymph nodes), and systemic (night sweats, persistent fevers, significant weight loss). These symptoms may indicate HIV progression; thus, prompt medical evaluation at a health center is crucial for management and treatment.

Table 1 categorizes oral health lesions in HIV-positive individuals, highlighting the prevalence of various conditions. The most frequently observed lesions are fungal infections like candidiasis and bacterial infections such as those resulting from cat scratches. Additionally, severe lesions associated with HIV, including Kaposi's sarcoma, erythematous candidiasis, and inflammatory conditions like periodontitis and gingivitis, are detailed due to their impact on oral health.

Table 2 presents a comprehensive overview of characteristics in HIV-infected individuals, organized by oral lesions, their etiology, specific problems, infection sites, associated symptoms, and diagnostic criteria. Each category is meticulously detailed to provide a clear understanding of the HIV-related oral health landscape.

Figure 3 outlines the World Health Organization's strategic plan through 2030, which ambitiously aims to significantly reduce the global impact of HIV. The strategy forecasts a 32% decline in new HIV infections and a notable 52% decrease in AIDS-related mortalities, reflecting the effectiveness of targeted interventions and improved healthcare access.

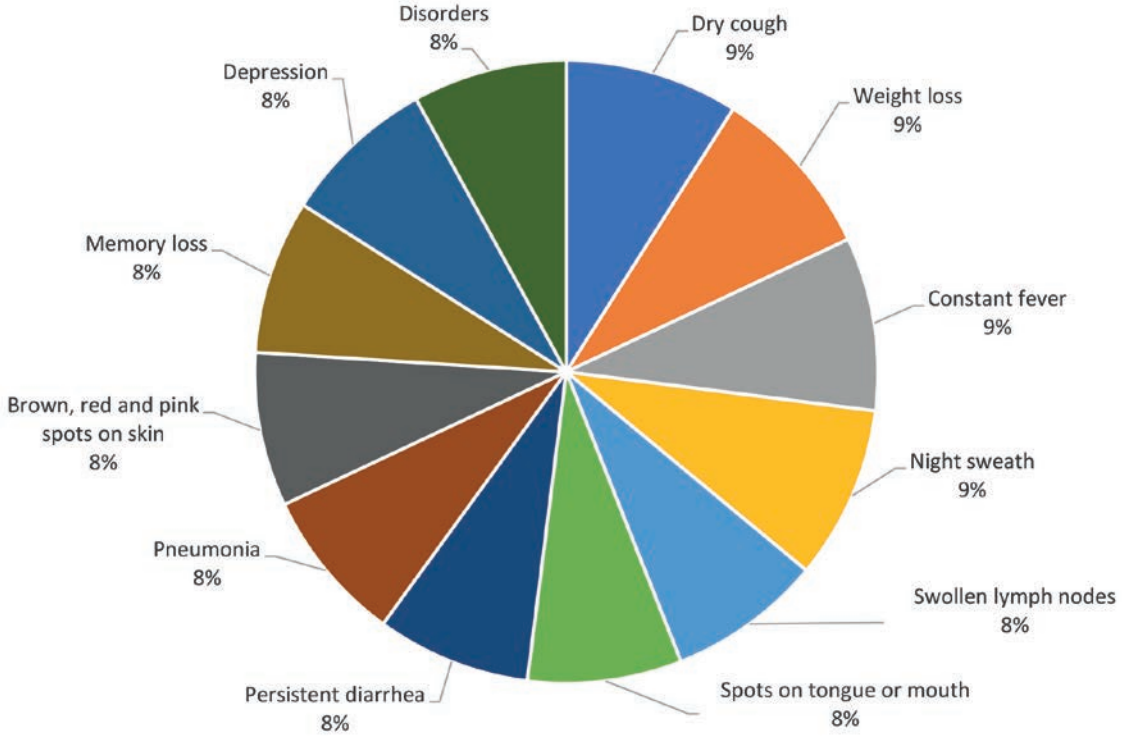

FIGURE 1. Symptoms of HIV (*Source:* Own elaboration)

TABLE 1. Oral health injuries in HIV-positive patients

Common (-) conditions	Common (+) conditions	Strong effects
Melanic pigmentations	CMV viral infections	Infection leukoplakia pilosa
Atypical bacterial infections	Fungal infections other than Candida spp.	Kaposi's sarcoma involvement
Non-specific ulcerations	Neurological disturbances: trigeminal neuralgia	Linfoma no Hodgkin
Salivary gland pathologies: Increased volume and xerostomia	Drug reactions	Oral candidiasis: Erythematous Pseudomembranous
Viral infections: Herpes simplex virus Human papillomavirus Virus varicela-zoster	Cat scratch disease	Periodontal disease: Ulcerative-necrotizing Linear gingival erythema Periodontitis and gingivitis

Source: Own elaboration

TABLE 2. Oral clinical features associated with HIV-positive patients

Oral Lesions	Aetiology - Description	Specification	Location	Symptoms	Diagnosis
Ulcers	Idiopathic E.	Red, yellow and white ulcers	Tongue, palate, lip mucosa	Burning sensation, constant pain	Clinical
Non-Hodgkin's lymphoma	E. multifactorial	Indurado, Solevantado, Ulcerated, Nodular, white, necrotic, and red in color	The whole area of the mouth such as the palate, oropharynx and gums	Pain when an ulcer develops	Biopsy
Kaposi's sarcoma as an oral lesion	Human herpes viruses	Raised, flat, macula, wine red, red and purple colored nodule	Located in the mouth area with a predilection for the palate and gums.	Asymptomatic in some cases pains when an ulcer invades areas of the mouth	Biopsy
Hairy leukoplakia	Epstein-Barr virus	Vertical or white corrugated	Located on the lateral edges of the tongue	Asymptomatic	Clinical
Gingivitis/ Periodontitis	Periodontal bacteria	Necrotic, foul red and white odor	Found in periodontal tissue and alveolar bone.	Toothaches, constant sensitivity	Clinical
Erythematous candidiasis	Candida fungus	Maculae or red plates	Palate or buccal mucosa	Asintomáticas	Clinical

Source: Own elaboration

Individuals with HIV are at an elevated risk for oral health complications, with over one-third experiencing such issues due to their heightened susceptibility to infections. This vulnerability can lead to conditions like warts, which, without timely intervention, may progress to more serious outcomes, including oral cancer.

Main oral affections

Candidiasis

According to De Souza et al. [10], pseudomembranous candidiasis predominantly develops in patients with low TCD4:TCD8 ratios and in individuals of non-Caucasian ethnicities. Although the pseudomembranous variant is the most common, associated exclusively with reduced levels of TCD4, the erythematous and hyperplastic forms are also common in those with HIV, as indicated by Vohra et al. [4]. Donoso et al. [11] identify pseudomembranous and erythematous candidiasis as the most usual types in patients under antiretroviral treatment, especially when TCD4 levels are below 200 cells/mm^3.

On the other hand, Meylani et al. [12] observed that, in a comparative study among subjects with candidiasis, those with HIV/AIDS presented Candida albicans hyphae with more complex morphologies, larger sizes and densities, as well as faster and more aggressive cell division, and accelerated morphogenesis. Furthermore, Owotade, Gulube & Patel [13] reported the emergence of various strains of Candida in their studies, noting a microevolution in the existing strains that enhances the transmission of infections. These mutated strains, being more virulent and resistant to pharmacological treatments, increase the risk for immunocompromised patients.

After the implementation of Highly Active Antiretroviral Therapy (HAART) in HIV patients, Du et al. [14] observed a significant decrease in Candida load and in TCD8 lymphocytes throughout the treatment. This resulted in an increase in the TCD4/TCD8 lymphocyte ratio and in the TCD4 count. However, the correlation between oral Candida load and TCD8 lymphocytes remains uncertain, with variable results throughout the study. Although Antiretroviral Therapies (ART) and combined therapies (cART) sig-

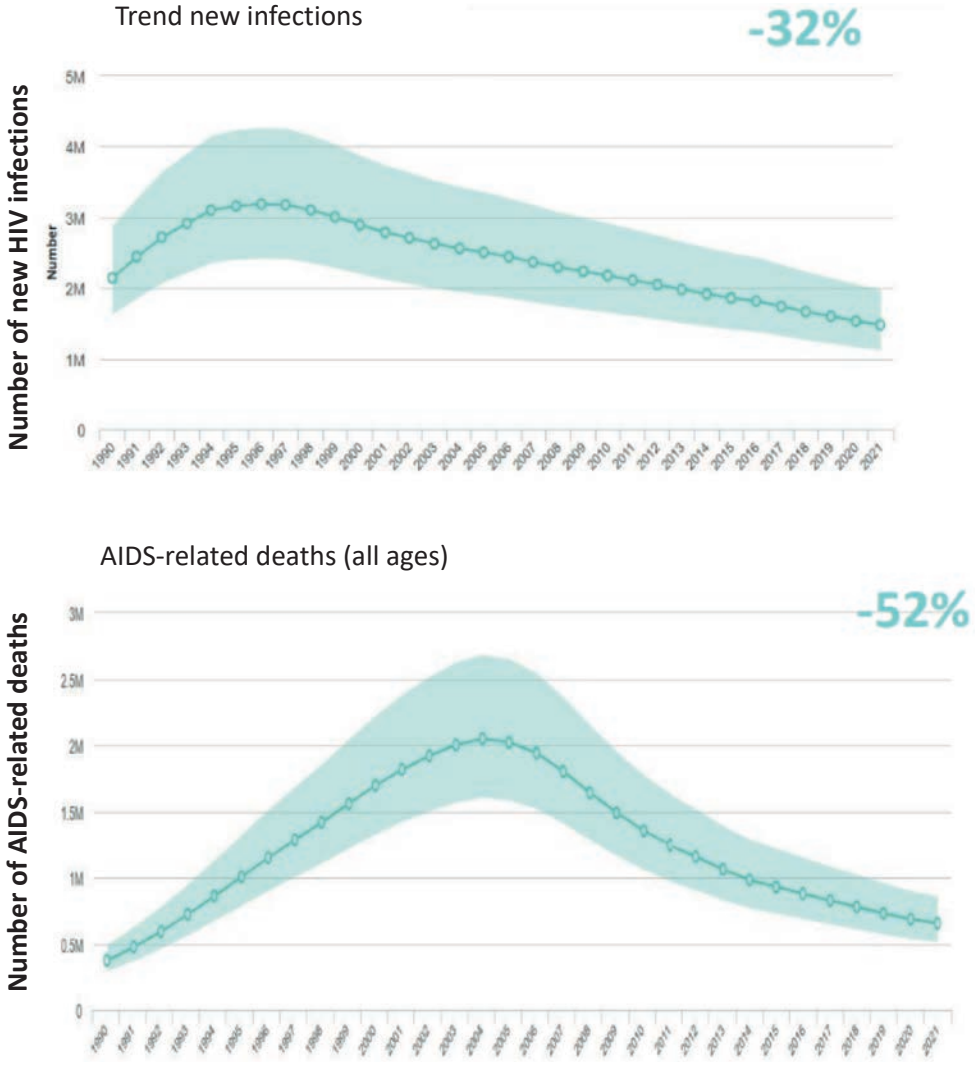

FIGURE 3. Strategy planning (*Source:* World Health Organization)

nificantly reduce the manifestations of candidiasis, they do not completely prevent them, which could indicate limitations in the efficacy of HAART, according to Lam et al. [15]. Furthermore, an increase in Candida load along with a reduction in salivary yeast has been reported [15]. In this context, Patel et al. [16] suggest the adoption of oral hygiene practices, including mouthwashes with fluoride and triclosan, to decrease the density of Candida albicans.

Hairy Leukoplakia (HL)

Hairy leukoplakia, an oral condition commonly associated with HIV infection, has been observed with greater prevalence in patients presenting TCD4 cell levels below 500 cells/mm³ [4]; highlighting the correlation between immunosuppression and the emergence of this oral pathology. On the other hand, De Souza et al. [10], reported a low incidence of hairy leukoplakia in patients receiving advanced antiretroviral treatments, such as Highly Active Antiretroviral Therapy (HAART) and Dual Retroviral Therapy (DRT). This phenomenon was particularly notable in those individuals with less than two years of treatment, regardless of their ethnic origin, whether Caucasian or non-Caucasian. In contrast, Lam et al. [15], found no significant differences in the prevalence of hairy leukoplakia between patients under antiretroviral treatment (ART) and those who were not, suggesting that the effectiveness of these treatments in preventing hairy leukoplakia might not be as decisive as previously thought. These studies highlight the complexity of the relationship between antiretroviral treatment and oral health in HIV patients, underscoring the need for a deeper understanding to improve prevention and treatment strategies for HL.

The detection of the Epstein-Barr virus (EBV) is typically conducted through a polymerase chain reaction (PCR) assay, which is a sensitive method for identifying viral DNA in samples. These samples are often obtained from lesions that manifest in infected individuals and are usually collected via surgical methods to ensure the integrity of the sample for accurate testing. It is important to note that the presence of EBV in peripheral blood samples is not a definitive indicator of disease progression or clinical outcome. This is particularly evident in cases of oral

hairy leukoplakia, an EBV-associated condition that can occur in immunocompromised patients, such as those with HIV/AIDS. Despite the detection of EBV in the blood, the clinical manifestation of the virus, including oral hairy leukoplakia, does not always correlate with a positive prognosis or an increase in viral activity. This suggests that the mere presence of EBV in the bloodstream is not a reliable marker for disease severity or progression [11]. The relationship between EBV in peripheral blood and clinical outcomes remains complex and warrants further investigation to fully understand its implications in the context of various EBV-associated diseases.

HIV Gingivitis

It has been observed that both gingivitis and Linear Gingival Erythema (LGE) are indicative of CD4 levels below 500 cells/mm³, with the individual's gender not influencing this association [4]. Although gingivitis is directly related to the individual's oral hygiene, LGE is almost exclusively associated with HIV/AIDS infection. This condition is present even in patients who are under highly active antiretroviral therapy (HAART) and is considered a variant of candidiasis [10]. On the other hand, Lam et al. [15] found that gingivitis is more frequent in children and adolescents who do not receive antiretroviral treatment (ART) or who are under combined antiretroviral therapy (cART), without finding significant differences in the incidence of this disease among those who do receive some type of treatment. As for LGE, no notable differences in prevalence were observed between treated and untreated patients, nor among the different types of treatments.

Oral health is a fundamental aspect of the overall well-being of individuals, especially those diagnosed with HIV. Recent studies have shown a significant correlation between nutritional deficiencies and the prevalence of oral pathologies. In particular, vitamin D, known for its crucial role in regulating the immune system and bone health, also appears to influence periodontal health. Insufficiency of this vitamin could be a contributing factor in the onset of oral diseases such as gingivitis, periodontitis, and dental caries. These conditions not only compromise the patient's quality of life but may also indicate a weakened immune state. Mumena et al. [17] highlight this connection, suggesting that an inadequate concentration of vitamin D in HIV patients could be intrinsically linked to an increased risk of developing such oral diseases. Therefore, it is imperative to consider vitamin D supplementation as an integral part of clinical management in this population, in order to improve their oral health and, consequently, their quality of life.

HIV Periodontitis

Among the most prevalent oral pathologies in HIV patients, periodontal abscesses and acute necrotizing ulcerative periodontitis stand out. Periodontitis, in particular, has been identified as the most widespread, especially in male patients, as pointed out by Vohra et al. [4]. Additionally, it has been observed that periodontitis with tooth mobility is more common in smoking patients who do not receive antiretroviral treatment; however, it has also been reported in those under highly active antiretroviral therapy (HAART), according to De Souza et al. [10]. Lam et al. [15] add that periodontitis and alveolar bone loss, associated with osteoporosis, are more frequent in adults than in children or adolescents, suggesting that these problems could manifest in adulthood after prolonged use of antiretroviral therapy (ART).

A study conducted in Rwanda by Murererehe et al. [18] revealed that dental caries are more common in individuals with HIV, attributed to poor oral health and quality of life. Interestingly, periodontitis was not reported with the same frequency, which could be due to the fact that, as it does not present painful symptoms, patients tend to ignore it and are not aware of its presence. On the other hand, Nannini et al. [19] hypothesize that the immunosuppression of the oral mucosa caused by HIV could alter the colonization of commensal bacteria, facilitating the development of caries and periodontal diseases. This is because the decrease in CD4 T cells and salivary immunoglobulin A (IgA) could promote the transformation of such commensal bacteria into more pathogenic microorganisms.

Acute Necrotizing Ulcerative Gingivitis (ANUG)

Acute Necrotizing Ulcerative Gingivitis represents a significant concern in the HIV-positive population, significantly affecting children and adolescents who do not receive antiretroviral therapy (ART), with an odds ratio of 0.00 and a 95% confidence interval of 0.00–0.02 [15]. According to the study by Donoso et al. [11], both gingivitis and acute necrotizing ulcerative periodontitis tend to occur in patients with CD4 T cell counts below 500 cells/mm³. On the other hand, Nannini et al. [19] observed a notable decrease in Mycoplasmatales and Treponema bacteria in saliva samples, with the latter being particularly associated with periodontitis and ANUG. This evidence led researchers to postulate that the activation of the immune system against other infections could result in the reduction of such oral microbiota.

Kaposi's Sarcoma (KS)

KS associated with HIV/AIDS is notably present in the oral cavity, primarily affecting the palate and gums. This neoplastic lesion not only causes dysphagia and potential secondary infections but can also extend to the lungs and gastrointestinal tract, complicating the clinical picture of the patient [20]. It has been observed that KS occurs more frequently

when CD4 T-cell counts are below 200 cells/mm³. The prevalence of this condition has been recorded with an odds ratio of 0.00 and a 95% confidence interval of 0.00–0.03, being more common in children and adolescents who are not under antiretroviral treatment (ART or cART). However, no significant difference in prevalence has been found between those who receive ART and those who do not, suggesting other factors at play [15]. Cesarman et al. [20] have also reported a higher incidence of KS in children, regardless of their HIV serostatus.

In terms of geographical distribution, studies such as those by Cesarman et al. [20] and Gonçalves, Uldrick & Yarchoan [21] have identified a higher prevalence of KS in regions like Sub-Saharan Africa, which could be related to specific endemic factors of these populations. A study conducted in Chile by Donoso et al. [11] suggests that the high frequency of KS observed could be influenced by local endemic factors. It is important to highlight that Kaposi's Sarcoma Herpesvirus (KSHV) has been identified as the etiological agent of KS, and it is suspected to be involved in the pathogenesis of other diseases not yet fully understood [21].

Non-Hodgkin's lymphoma NHL

Non-Hodgkin's lymphoma is the second most common dangerous neoplasm in patients with HIV, presenting as a large, soft tissue mass with necrosis, often affecting oral mucosa and mimicking periodontal pathology [22]. These lesions, clinically heterogeneous and irregular, are considered highly malignant in HIV patients, similar to Kaposi's sarcoma. However, antiretroviral therapy (ART) has reduced their incidence [11]. A U.S. study observed a decrease in NHL cases and mortality following HAART, but noted an increase in Burkitt's lymphoma cases, suggesting a complex relationship with immunosuppression [23]. Rare NHL cases in the jaw indicate a dire prognosis without timely diagnosis and are often harbingers of HIV/AIDS infection [24]. Kamat et al. [25] reported an unusual case of Burkitt's lymphoma associated with HIV/AIDS, emphasizing that such manifestations are indicative of early immunodeficiency, thus underscoring the importance of rapid differential diagnosis for appropriate treatment.

Herpes labialis

Also known as Simplex Herpes Infection (ISH) or Herpetic Ulceration (UH), has been predominantly reported in Asia in recent decades [6]. Recurrence of herpes labialis in HIV individuals has been identified, alongside herpes zoster [4]. Lam et al. [15] found no significant differences between children and adolescents with/without treatment or between ART and cART therapies.

Angular cheilitis (AC)

Commonly caused by Candida or a combination of Candida-Staphylococcus aureus [26], primarily affecting individuals under 35 years, including children and adolescents [26]. Additionally, β-hemolytic streptococci are noted as the third leading cause of microbial infection [26]. Meta-analysis studies show low prevalence of AC in HIV/AIDS patients under HAART treatment (RR 0.53, 95% CI 0.30–0.96) [27], corroborated by Patil et al. [28], who found AC prevalence in patients not under HAART with an average CD4 count of 258.82 cells/mm³. Moreover, when CD4 counts fall below 200 cells/mm³, there's a higher prevalence of mixed Candida-Staphylococcus infection [26]. However, similar to herpes labialis, Lam et al. [15] found AC was not prevalent among individuals with/without treatment and between different therapies.

Bacterial infections

It is well known that the oral cavity is an ecosystem rich in microbiota. In patients with HIV, chronic bacterial infections such as periodontitis not only lead to tooth loss, but the resulting dysbiosis can enhance HIV replication and affect its progression, as indicated by Pólvora et al [8]. A comparative study of oral hygiene in children and adolescents with and without HIV revealed that those infected presented lower levels of hygiene, even after improving their oral care practices. This phenomenon has a direct impact on viral load and salivary flow, as well as on Body Mass Index (BMI), as oral conditions and infections can decrease appetite and alter salivation [29]. These findings underscore the importance of implementing specialized oral health programs for people with HIV.

Human papillomavirus

Riddell et al [30] suggest that in HIV patients with CD4 T-cell levels below 200 cells/mm³ and viral loads above 200 copies/mm3, the incidence, prevalence and persistence of Human Papillomavirus (HPV) in oral conditions is significantly higher, with a prolonged recovery period of about 16 months. The prevalence of HPV is observed mainly in heterosexual men and bisexual women. HPV infection of the oral mucosa is associated with various clinical entities, the manifestations of which can range from benign to papillomatous or wart-like lesions [31]. As a consequence, squamous cell carcinoma, verruca vulgaris, condyloma acuminatum, and focal epithelial hyperplasia have been identified to be associated with the presence of the virus. This has increased interest in the analysis of these lesions in recent years, given their potential transformation into malignant or squamous cell tumors [32].

Access to oral health care

The high mortality associated with the human immunodeficiency virus (HIV) leads to limited or even non-existent access to dental services for those affected. This is partly due to a lack of knowledge about HIV among some dental professionals, who refuse to provide care to these patients. In addition, prejudice, stigmatization, and fear within the community cause immunodeficient individuals to feel discouraged from seeking such services [33]. This rude fact leads HIV individual to fall into depression, its due the correlation between oral health and Mental Health [34]. It has been proposed that the responsibility for the oral health of these individuals should fall on government entities, through the implementation of programs and campaigns specifically for people with HIV [33]. On the other hand, Oberoi et al. [35] suggest that the training and education of future dentists are key to ensuring proper care for HIV patients. They argue that, in accordance with professional ethics and the Hippocratic oath, health professionals have a duty to provide care to anyone in need.

DISCUSSION

Studies such as those by Kamat et al. [25] have highlighted that early signs of HIV infection often manifest in the oral cavity. Oral diseases and infections are common in individuals with weakened immune systems, as noted by Patel [16]. Despite maintaining good oral hygiene, the dysbiosis caused by immunodeficiency facilitates the replication and mutation of bacterial strains, including Candida, as described by Polvora et al. and Kikuchi et al. [8,29]. Critical factors impacted by immunodeficiency include viral load, which is evident in oral pathologies and a decrease in salivary flow, resulting in a reduction of body mass index (BMI) due to loss of appetite in patients [29]. These descriptions point to oral complications stemming from HIV as contributors to a cycle that progressively deteriorates an individual's health.

Furthermore, it has been reported that the primary indicators for the incidence of most oral infections are TCD4 and TCD8 T-cell levels, along with viral load [10]. In response, antiretroviral therapies such as HAART, ART, and cART have demonstrated efficacy in reducing viral load and TCD8 T-cell levels, despite ongoing uncertainties between these indicators [14]. However, researchers like Lam et al. [15] suggest that such therapies may not entirely prevent these conditions. According to this perspective, it is inferred that due to each individual's genetic diversity, the impact of HIV and the effectiveness of treatment can vary. Moreover, this could be attributed not only to individual factors but also to endemic ones, as suggested by Gonçalves, Uldrick & Yarchoan [21].

Microscopically, it has been observed that Candida albicans exhibit more complex morphologies with rapid evolution and replication, thereby increasing their virulence and drug resistance [12,13]. This is despite the availability of antiretroviral therapies such as HAART and ART. For instance, Lam et al. [15] determined that individuals, whether treated or untreated, were equally affected by HL. An important factor for this could be what Munena et al. [17] suggested when they posited that a deficiency in vitamin D may increase the risk of developing oral diseases, regardless of the treatment being administered.

The prevalence of specific oral infections varies across age groups. For instance, Lam et al. [15] indicate that gingivitis and ANUG is commonly found in children and adolescents, especially those who are not under therapy, whereas periodontitis is more prevalent among adults. A particularly dangerous characteristic of periodontitis is its painlessness in early stages, leading many to overlook its presence until the damage becomes advanced and irreversible [18]. In addition to periodontitis, cavities are common afflictions among the immunocompromised due to the transformation of commensal bacteria into more pathogenic microorganisms [19].

ANUG, a common oral infection manifestation among the immunocompromised due to HIV, may be suppressed by the presence of other oral infections. This interplay of conditions suggests that certain ailments like ANUG could be mitigated, as theorized by Nannini et al. [19], who discuss the role of microplasmas and treponemes in saliva. This finding is crucial as it suggests that the interaction between the immune system and the oral microbiota in HIV patients could play a decisive role in the prevalence of periodontal diseases. Understanding these mechanisms is essential for developing more effective preventive and therapeutic strategies to combat ANUG and other periodontal diseases in this vulnerable population.

However, there is also the risk of combination and fusion of various bacteria, leading to more complex infections. As described by Pandarathodiyil et al. [26], De Almeida et al. [27], and Patil et al. [28], angular cheilitis develops at CD4 counts averaging 258 cells/mm3, and at counts below 200, the condition is exacerbated by the coexistence of Candida and Staphylococcus bacteria.

Finally, it is crucial to note that the types of risk factors identified by the WHO influence the specific type of infection/disease. Riddell et al. [30] report that the likelihood of developing HPV is higher in heterosexual men and bisexual women compared to their counterparts (homosexual men, heterosexual women, or lesbians). According to the authors,

this virus affects men more predominantly and is primarily transmitted by women, suggesting that the latter may have developed some degree of immunity to HPV.

CONCLUSION

According to the literature review conducted, it was identified that certain oral diseases and infections manifest according to age range and triggering risk factors. Studies have found that even with the application of ART and HAART therapies, these do not guarantee the absence of oral infections. This could be due to individual genetic factors or endemic factors of each region. The main causes of these diseases are primarily related to CD4, CD8 T cell counts, and viral load, with CD4 levels being decisive in the manifestation of ailments.

Oral infections are often indicative of HIV infection, necessitating serological biopsy and timely diagnosis since symptoms do not always follow a defined pattern for a disease/infection, which in advanced stages can be fatal. Beyond physical health effects, there is a mental psychological impact on self-esteem, lifestyle, and quality of life, often leading to a vicious cycle of deterioration.

Common infections include candidiasis, hairy leukoplakia, periodontitis, gingivitis, Kaposi's sarcoma, ulcers, human papillomavirus (HPV), and angular cheilitis. Rare cases such as non-Hodgkin lymphomas in the jawbone were also reported. Uncertainties like the relationship between Burkitt's lymphoma and the immunosuppressive system or oral Candida albicans bacteria with CD8 T cells were found in the literature. Therefore, further research is necessary in these not well-understood areas. Additionally, there is a need for developing new variants of antiretroviral therapies to increase their effectiveness in controlling HIV/AIDS and mitigating oral infections/diseases that directly affect the quality of life of those infected.

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REFERENCES

1. Pan American Health Organization [Internet]. HIV-AIDS. [updated 2022; cited 2024 Jan 10]. https://lc.cx/9T2vhX
2. He N. Research Progress in the Epidemiology of HIV/AIDS in China. *China CDC weekly.* 2021 Nov,3(48):1022-1030. https://doi.org/10.46234/ccdcw2021.249
3. World Health Organization [Internet]. HIV and AIDS. Key facts. [updated 2023 July 13; cited 2024 Jan 10]. https://lc.cx/s4CQRN
4. Vohra P, Jamatia K, Subhada B, Tiwari RV, Althaf MS, Jain C. Correlation of CD4 counts with oral and systemic manifestations in HIV patients. *J Family Med Prim Care.* 2019 Oct;8(10):3247-52. https://doi.org/10.4103/jfmpc.jfmpc_767_19
5. Lomelí-Martínez SM, González-Hernández LA, Ruiz-Anaya ADJ, Lomelí-Martínez MA, Martínez-Salazar SY, Mercado González AE, et al. Oral Manifestations Associated with HIV/AIDS Patients. *Medicina.* 2022 Sep;58(9):1214. https://doi.org/10.3390/medicina58091214
6. El Howati A, Tappuni A. Systematic review of the changing pattern of the oral manifestation of HIV. *J Investig Clin Dent.* 2018 Jul;9(4):e12351. https://doi.org/10.1111/jicd.12351
7. Lomeli-Martinez SM, González-Hernández LA, Villanueva JFA, Valentín-Goméz E, Ratkovich-González S, Alvarez-Zavala M, Sánchez-Reyes K, Cabrera-Silva RI, Varela-Hernández JJ. In vitro Azole antifungals susceptibility of Candida spp. isolates from HIV-infected patients with periodontitis. *J Med Mycol.* 2022 Aug;32(3):101294. https://doi.org/10.1016/j.mycmed.2022.101294
8. Pólvora TLS, Nobre ÁVV, Tirapelli C, Taba JM, De Macedo LD, Santana RC, et al. Relationship between human immunodeficiency virus (HIV-1) infection and chronic periodontitis. *Expert Rev Clin Immunol.* 2018 Apr;14(4):315-327. https://doi.org/10.1080/1744666X.2018.1459571
9. Manterola C, Rivadeneira J, Delgado H, Sotelo C, Otzen T. ¿Cuantos tipos de revisiones de la literatura existen? Enumeración, descripción y clasificación. Revisión cualitativa. *Int J Morphol.* 2023 May;41(4):1240-53. http://dx.doi.org/10.4067/S0717-95022023000401240
10. De Souza BKL, Faé DS, Lemos CAA, Verner FS, Machado RA, Ortega RM, De Aquino SN. Associated oral manifestations with HIV southeastern Brazilian patients on antiretroviral therapy. *Braz J Otorhinolaryngol.* 2023 Jun,89(3):425-431. https://doi.org/10.1016/j.bjorl.2023.01.001
11. Donoso-Hofer F, De la Maza-Acevedo J, Cornejo-Ovalle M. Oral manifestations and CD4+ T-lymphocyte counts in adult HIV-infected patients seen at Hospital San Juan de Dios. Santiago, Chile. *Chilean J Infect Dis.* 2022 Jul,39(4):413-420. http://dx.doi.org/10.4067/s0716-10182022000400413
12. Meylani V, Sembiring L, Fudholi A, Wibawa T. Differentiated sap (4–6) gene expression of Candida albicans isolates from HIV-positive patients with oral candidiasis and commensals in healthy individuals. *Microb Pathog.* 2021 Sep,158. https://doi.org/10.1016/j.micpath.2021.105075
13. Owotade FJ, gulube Z, Patel M. Oral Candida albicans strain diversity and maintenance in HIV positive women in South Africa. *Arch Oral Biol.* 2024 Aug;164:106007. https://doi.org/10.1016/j.archoralbio.2024.106007
14. Du X, Xiong H, Yang Y, Yan J, Zhu S, Chen F. Dynamic study of oral Candida infection and immune status in HIV infected patients during HAART. *Arch Oral Biol.* 2020 Jul,115. https://doi.org/10.1016/j.archoralbio.2020.104741
15. Lam PPY, Zhou N, Yiu CKY, Wong HM. Impact of Antiretroviral Therapy on Oral Health among Children Living with HIV: A Systematic Review and Meta-Analysis. *Int J Environ Res Public Health.* 2022 Sep;19(19):11943. https://doi.org/10.3390/ijerph191911943
16. Patel M. Oral cavity and candida albicans: Colonisation to the development of infection. *Pathogens.* 2022 Mar;11(3):335. https://doi.org/10.3390/pathogens11030335
17. Mumena CH, Mudhihiri MH, Sasi R, Mlawa M, Nyerembe S, Akimbekov NS, Razzaque MS. The relevance of vitamin D in the oral health of HIV infected patients. *J Steroid Biochem Mol Biol.* 2021 Jul;(211):105905. https://doi.org/10.1016/j.jsbmb.2021.105905
18. Murererehe J, Malele-Kolisa Y, Niragire F, Yengopal V. Oral health-related quality of life among people living with HIV and HIV-negative adults in Kigali, Rwanda: a comparative cross sectional study. *BMC Oral Health.* 2024 Jan;24(1):128. https://doi.org/10.1186/s12903-023-03828-9
19. Nannini G, Di Gloria L, Russo E, Sterrantino G, Kiros ST, Coppi M, et al. Oral microbiota signatures associated with viremia and CD4 recovery in treatment-naïve HIV-1-infected patients. *Microbes Infect.* 2024 Apr, 105339. https://doi.org/10.1016/j.micinf.2024.105339
20. Cesarman E, Damania B, Krown SE, Martin J, Bower M, Whitby D. Kaposi Sarcoma. *Nat Rev Dis Primers.* 2019 Jan;5(1):9. https://doi.org/10.1038/s41572-019-0060-9
21. Gonçalves PH, Uldrick TS, Yarchoan R. HIV-associated Kaposi sarcoma and related Diseases. *AIDS* (London, England). 2017 Sep;31(14):1903-16. http://doi.org/10.1097/QAD.0000000000001567

22. Jácome RFA, Chavarrea GFP, Balseca JCP. Oral problems experienced by people with HIV. Contemporary Dilemmas: Education, Politics and Values. 2022 Dec,(71). https://doi.org/10.46377/dilemas.v10i18.3445
23. Howlader N, Shiels MS, Mariotto AB, Engels EA. Contribution of HIV to Non.Hodgkin lymphoma mortality trend in the United States. *Cancer Epidemiol Biomarkers Prev.* 2016 Sep;25(9):1289-96. https://doi.org/10.1158/1055-9965.EPI-16-0273
24. Neerupakam M, Prakash J, Koduri S, Vishnubhatla T. Non-Hodgkin's lymphoma of the mandible in HIV patient - A Rare Case Report. *Contemp Clin Dent.* 2018 Mar;9(1):110-3. https://lc.cx/HWHJc8
25. Kamat M, Datar U, Kanitkar S, Byakodi S. Intraoral HIV-associated Burkitt's lymphoma: a rare case report with special emphasis on differential diagnosis. *J Korean Assoc Oral Maxillofac Surg.* 2019 Aug,45(4):225-9. https://doi.org/10.5125/jkaoms.2019.45.4.225
26. Pandarathodiyil AK, Anil S, Vijayan SP. Angular Cheilitis - An Updated Overview of the Etiology, Diagnosis, and Management. *Int J Dent Oral Sci (IJDOS).* 2021 Feb;8(2):1600-15. http://dx.doi.org/10.19070/2377-8075-21000317
27. De Almeida VL, Lima IFP, Ziegelmann PK, Paranhos LR, De Matos FR. Impact of highly active antiretroviral therapy on the prevalence of oral lesions in HIV-positive patients: a systematic review and meta-analysis. *Int J Oral Maxillofac Surg.* 2017 Jul,46(11):1497-1504. https://doi.org/10.1016/j.ijom.2017.06.008
28. Patil N, Chaurasia VR, Babaji P, Ramesh D, Jhamb K, Sharma AM. The effect of highly active antiretroviral therapy on the prevalence of oral manifestation in human immunodeficiency virus-infected patients in Karnataka, India. *Eur J Dent.* 2015 Sept,9(1):47-52. https://doi.org/10.4103/1305-7456.149640
29. Kikuchi K, Tuot S, Yasuoka J, Murayama M, Okawa S, Shibanuma A, et al. Impact of oral intervention on the oral and overal health of children living with HIV in Cambodia: a randomized controlled trial. *BMC Medicine.* 2023 Apr;21(1):162. https://doi.org/10.1186/s12916-023-02862-2
30. Riddell J, Brouwer AF, Walline HM, Campredon LP, Meza R, Eisenberg MC, et al. Oral human papillomavirus prevalence, persistence, and risk-factors in HIV-positive and HIV-negative adults. *Tumour Virus Res.* 2022 Jun;13:200237. https://doi.org/10.1016/j.tvr.2022.200237
31. Pupo-Marrugo S, Carmona-Lorduy M, Sánchez-Tatis A, Werner LC, Rocha-Herrera B. Typing of human papillomavirus in oral cavity lesions. Study developed in the stomatology service, Faculty of Dentistry of the University of Cartagena and the German Hospital of Buenos Aires. *Acta Odontológica Colombiana.* 2022 Jan,12(1):29-39. https://doi.org/10.15446/aoc.v12n1.97247
32. Conde-Ferráez L, Chan-Mezeta A, Gómez-Carballo JG, Ayora-Talavera G, González-Losa MDR. Human Papillomavirus Genotypes Infecting the Anal Canal and Cervix in HIV+ Men and Women, Anal Cytology, and Risk Factors for Anal Infection. *Pathogens.* 2023 Feb,12(2):252. https://doi.org/10.3390/pathogens12020252
33. Feng I, Brondani M, Bedos C, Donnelly L. Access to oral health care for people living with HIV/AIDS attending a community-based program. *Can J Dent Hyg.* 2020 Feb,54(1):7-15. https://lc.cx/c93Hev
34. Da Costa Vieira V, Lins L, Sarmento VA, Netto EM, Brites C. Oral health and health-related quality of life in HIV patients. *BMC Oral Health.* 2018 Aug;18(1):151. https://doi.org/10.1186/s12903-018-0605-4
35. Oberoi SS, Sharma N, Mohanty V, Marya C, Rekhi A, Oberoi A. Knowledge and attitude of faculty members working in dental institutions towards the dental treatment of patients with HIV/AIDS. *Int Sch Res Notices.* 2014 Oct, 2014. https://doi.org/10.1155/2014/429692