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NARRATIVE REVIEW

THE EFFECT OF ANTIRETROVIRAL THERAPY ON THE ORAL AND PERIODONTAL STATUS OF PATIENTS WITH HIV/AIDS: NARRATIVE REVIEW

EL EFECTO DE LA TERAPIA ANTIRRETROVIRAL EN EL ESTADO ORAL Y PERIODONTAL DE PACIENTES CON VIH/SIDA: REVISIÓN NARRATIVA

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Keywords: Periodontitis; periodontal disease; HIV, antiretroviral therapy; ART; highly active antiretroviral therapy; HAART.

ABSTRACT

Background: Patients with HIV have a decrease in CD4+ T cells, making them more susceptible to developing infections. Antiretroviral therapy (ART) decreases viral load and improves T-CD4 production. It has been suggested that periodontitis could decrease its prevalence due to the use of antiretrovirals.
Objective: To identify, through a literature review, the most recent and relevant evidence of patients with HIV and the effect of ART on oral and periodontal status.
Materials and Methods: A search for clinical articles was carried out in PubMed, Science Direct LILACS and Google Scholar, between the years 2011 and 2023. Selection criteria: patients with ART for HIV and evaluation of oral/periodontal status. Clinical trials, systematic reviews and meta-analyses were included.
Results: Initially, 173 articles were identified, 135 were excluded, finding in the end only two systematic reviews and no clinical trials. One systematic review presented 18 articles with 1632 adult patients with periodontal disease (PD) and highly active antiretroviral therapy (HAART) and the other in children with 12 articles and 1002 patients <18 years of age reviewing periodontal status and oral lesions.
Conclusion: HAART reduces the prevalence of oral manifestations in children with HIV; but not so with PD in adult patients with HAART, with the exception of necrotizing gingivitis.

CLINICAL RELEVANCE

The review provides valuable information on the relationship between ART and oral/periodontal health in patients with HIV, highlighting the following factors:

- It is possible that antiretroviral therapy has a positive impact on periodontal health in patients with HIV, decreasing disease prevalence and severity.
- Periodontal intervention may be beneficial in patients with HIV, especially when combined with antiretroviral therapy.
- In pediatric patients, duration of antiretroviral therapy and socioeconomic status may influence the presence of HIV-related oral lesions.

INTRODUCTION

Patients with human immunodeficiency virus (HIV), due to alterations in their immune system, are more susceptible to infections and damage to different organs; they present changes in the intestinal and oral mucosa associated with changes in the microbiota and it has been reported that in the oral cavity these alterations typical of HIV in early stages, are associated with a low count of T-CD4+ lymphocytes that directly or indirectly affect the microbial symbiosis and may be related to the presence of periodontal disease. Other oral diseases in these patients include dental caries, endodontic infections and oropharyngeal candidiasis among others. It has been recognized that the oral microbiota is important in the etiology of many of these diseases, and HIV infection and decreased T-CD4+ cells can alter the balance between host immunity and endogenous microbiota and can affect oral tissue health and local immunity, leading to increased susceptibility to pathogenic microbes in the oral cavity, especially periodontal pathogens. The treatment used for HIV is antiretroviral therapy (ART) and is a regimen of several drugs taken daily that prevent the virus from replicating by reducing the viral load in the body and the concentration of HIV virus, allowing the immune system to tend to recover and produce more T-CD4+ lymphocytes, helping to fight infections and diseases such as cancer related to this disease. Highly active antiretroviral therapy (HAART) uses several drugs, including fusion inhibitors, which prevent HIV from entering T-CD4+ cells, and CCR5 antagonists, which work by blocking the CCR5 protein needed for HIV to enter T-CD4+ cells.[1,2]

In periodontitis it has been established that changes in T-CD4+ cell counts occur, and have been significantly related to probing depth and clinical attachment loss, so it has been suggested that in HIV patients with antiretroviral therapy (HAART) it could decrease the prevalence of periodontitis due to its relationship with T-CD4+ cell counts. The evidence is scarce and controversial, some authors have reported a decrease in periodontitis in patients with HAART, but it has also been reported that there are no significant differences when compared to other groups.1 Recent clinical evidence has found favorable results in these patients when they have periodontal disease or when the presence of periodontitis is low in patients with HIV and HAART.[1,2]

MATERIALS AND METHODS

Article search

A literature search was performed answering the question: What is the effect of antiretroviral therapy on the oral periodontal status of patients with HIV/AIDS? It was performed in 4 scientific journal search engines in English: PubMed, Science Direct and in Spanish LILACS and Google Scholar, in a period of time between the year 2011 and 2023. The search included the words “HIV”, “Periodontitis”, “Periodontal status” and “AIDS”, “Periodontal disease”, “Gingivitis” and “HIV Infections” and the Boolean operators “AND” and “OR” were used. The search strategy was carried out using MeSH (Medical Subject Headings) and DeCS (Health Sciences Descriptors) terms. The search was performed in PubMed and then adapted to the other databases with the following formulas:

- **PubMed:** ((HAART era) OR HAART) OR Antiretroviral therapy) OR Treatment with HAART) OR HIV infected patients) OR HIV adults) AND Periodontal status) OR Periodontal Disease) OR Oral manifestations) OR HIV-associated Periodontitis) OR oral health status) OR Necrotizing ulcerative gingivitis/periodontitis) OR NUG) OR NUP) OR chronic periodontitis) AND highly active anti-retroviral therapy"
- **Science Direct:** HAART, antiretroviral therapy, HIV and periodontitis
- **LiLACS**: Enfermedad periodontal, Periodontitis, lesiones orales, terapia antirretroviral, VIH

Article selection and data extraction

The selection criteria were articles that included patients with HIV diagnosis and antiretroviral treatment and assessment of oral/periodontal status. Only clinical trial studies, systematic reviews and meta-analyses were included. Cross-sectional studies, cohort studies, subject reviews, case-control, in vitro, animal, ideas, opinions, editorials, studies that included patients were excluded. One researcher (LGR) initially performed the total search through titles and abstracts meeting the selection criteria and filtering out non-compliant and repeated studies. Two investigators (OPC) (SA) confirmed the search and the definition of the selected articles.

A complete reading of the articles selected individually by the researchers was carried out and an Excel matrix was filled out to collect and unify the information. The quality of the selected articles followed the PRISMA guide Figure 1.

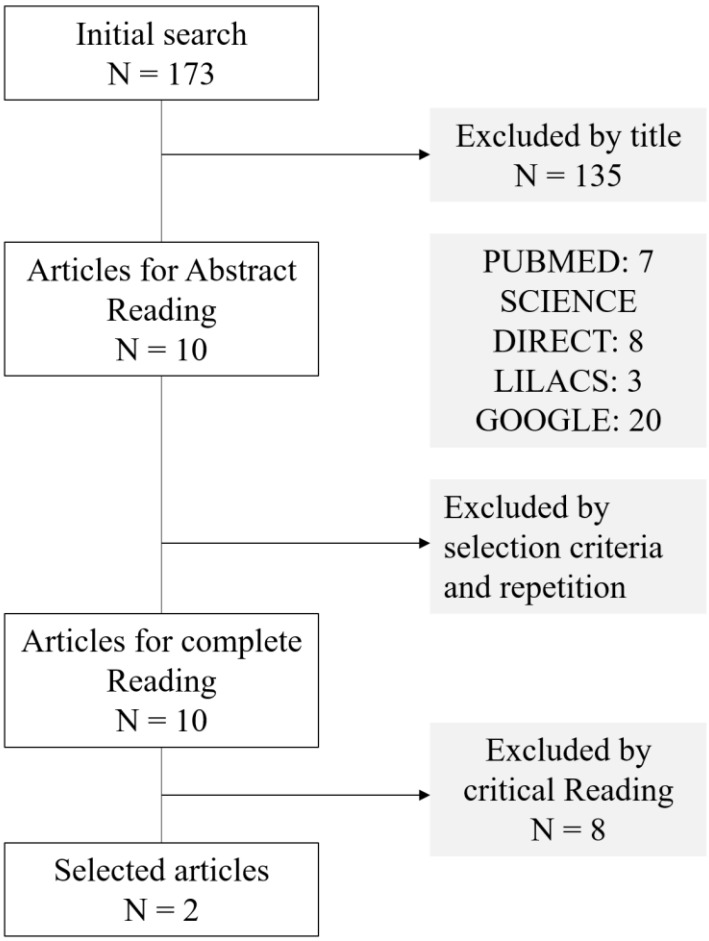

Figure 1. Search for article selection.

RESULTS

The search was based on the scientific evidence of periodontal diseases including gingivitis and periodontitis in HIV-positive or AIDS patients, adults and children, as well as their relationship with highly active antiretroviral therapy (HAART) from which 2 systematic reviews and meta-analyses were finally selected.[1,2]

Ntolou et al (2023)(1), analyzed 18 articles, based on the PICO strategy: P: HIV-positive patients, I: antiretroviral treatment (HAART), C: patients not receiving HAART and O: periodontal diseases and severity. In total, 1632 patients with HAART treatment and 1926 without HAART were reported. The articles reviewed were descriptive cross-sectional, cohort, case-control, with follow-up before and after HAART, between the years 2001 to 2017 in adult population.[1]

In the systematic review by Phoebe et al (2022)[2] included 12 articles, based on the PICO(S) strategy: P: Children and adolescents under 18 years of age; I: Patients on ART (antiretroviral therapy) and HAART (treatment with a combination of three or more antiretroviral drugs); C healthy control patients; O: Outcomes of dental caries, oral hygiene, periodontal health status, HIV-related orofacial diseases such as angular cheilitis, herpes zoster, linear gingival erythema, recurrent oral ulcerations, parotid enlargement, oral candidiasis, oral hairy leukoplakia, acute necrotizing ulcerative gingivitis/periodontitis herpes simplex infection, Kaposi's sarcoma; S: Observational case-control studies In total they reported 1002 HIV-infected subjects and 975 healthy controls, between the years 2002 to 2016 in pediatric population. [2]

The included studies [1,2] were mainly related to the effect of antiretroviral therapy (ART) and highly active antiretroviral therapy (HAART) on the oral and periodontal status of patients with HIV/AIDS in children as well as in adults. Studies [1,2] showed lower prevalence and severity of oral manifestations with HAART. In addition, HIV patients who were not on ART had higher levels of viral load and inflammatory cytokines, as well as lower levels of T-CD4+ cells (Table 1).

Table 1. Included Studies.

Author, Year and Country	Type of Study	Characteristics	Methodology	Results	Conclusion
Panagiota Ntolou et al. (2022) (1) Grecia	Systematic review and meta-analysis	18 Articles: Cohort, case-control and cross-sectional. 7: GN - 5:PN -9:P 3: effect of HAART on the clinical diagnosis of BP and CIN (4 or 6 sites per tooth) 1632 patients undergoing HAART 1926 non-HAART Males and females	Prevalence of oral lesions in HIV-positive adults on and off HAART. Monitored before and after taking HAART. EXCLUSION: Case reports, literature reviews. No antiretroviral therapy (no control group). Studies before 1996.	NG: 7 studies: 1164 p with HAART and 629 without HAART. With HAART: 55% less GN with statistical significance GN occurring in 54.9% less when there is HAART treatment (RR = 0.34 (p = .033). NP: studies: 762 with HAART and 203 without HAART.	HAART has a statistically significant impact on the prevalence of GN. No significant effects on necrotizing periodontitis, periodontitis, pocket depth or clinical attachment level were observed in HIV patients on HAART.

			SCREENING AND SELECTION OF PAPERS 2 reviewers for the search A 3rd reviewer resolved disagreements. DATA EXTRACTION Access to full text articles	HAART did not seem to affect the prevalence of NP (RR = 0.64, p = 0.437). P: 9 studies: 726 with HAART and 466 without HAART. HAART did not affect prevalence (RR= 1.08, p= .644). PB: 3 studies: 110 with HAART -72 without HAART. HAART does not seem to affect PB (RR = 0.00 (p = 0.985) CIN: 3 studies: 134 patients with HAART and 98 patients without HAART. HAART did not seem to affect CAL (RR = 0.00 (p = 0.985)	Studies reviewed: NO clinical trials.
Phoebe et al (2022) (2) China	Systematic review and meta-analysis	12 articles: cases and controls 2:CD - 2: HO, EP and G - 1: SigA - 5:CO - 2: Ddnt *1002 HIV subjects from hospitals, clinics or AIDS centers; *975 healthy controls were siblings or subjects from school and clinics. *1028 pts CD prevalence *250 subjects tested EP-HO-G Boys and girls	*4 databases: Ovid Embase, Ovid MEDLINE, Pubmed and Scopus from inception to 29 July 2022. *2 reviewers: titles and abstracts. *3rd reviewer: resolved disagreements. Subgroups separately compared different outcomes in control (e.g., dentitions, CD4+ T-cell counts, durations and types of ART). *Low quality evidence = observational studies.	CD: 2 studies 1028 pts; prevalence of CD higher in children with ART in both dentitions (dd: OR = 2.49, p < 0.001; dp: OR = 1.93 p < 0.001). HO, EP and G: 250 pts: HO 1 study. no significant difference between children with and without HIV. PD and G: 2 studies: More prevalence of PD among children and adolescents with ART more prevalence of G with moderate or	Children with HIV taking ART have a high prevalence of CD, gingivitis and oral problems. Factors such as dental development, CD4+ cell count, duration of antiretroviral treatment and periodontal disease do not show significant differences.

				severe suppression. OR = 3.11 p = 0.001. EO-HIV: Not in healthy pts (OR=1.95; p=0.667). SIgA: 1 study. No significant differences HIV-ART, HIV-HAART and healthy controls, CO: 5 studies: Present with ART and HAART (OR=16.94, p=0.944). Ddnt: 2 studies: < in M-HIV and controls than chronological age; H-HIV with no significant difference with chronological age. OFA: No significant difference in OI with ART for 3 years and more than 3 years. HIV-positive pts, 2 times more likely to EO-HIV (OR = 1.916, p.= 0.001).	

DISCUSSION

Periodontal status in HIV-positive adult patients

John et al. (2013)[3] observed periodontitis based on several factors such as T-CD4+ T-cell counts, and significantly correlated clinical indices of probing depth and clinical attachment loss, but found no association with immunosuppression stage. They also found an interrelation between age, gingival plaque indices and probing depth, but not with clinical attachment loss. Smoking did not significantly affect T-CD4+ T-cell counts, but influenced several periodontal clinical indices.[3]

Rozra et al. (2012),[4] Qadir, S., et al. (2016),[5] and Nouaman, M. N., et al. (2015),6 noted an association between HIV infection and periodontitis, finding that the prevalence of periodontitis was higher in people with HIV infection compared to those who were not infected. A higher frequency of periodontitis was observed in the HIV-infected compared to the HIV-uninfected groups and a lower T-CD4+ count in those with periodontitis.

Periodontal status in adult HIV-positive patients on antiretroviral therapy

Research focusing on analyzing oral manifestations observed in HIV-positive individuals on antiretroviral therapy has been conducted worldwide 7-9 Eyeson et al. (2002),[10] found that there were no significant differences in oral manifestations between patients on ART with dual therapy and patients on HAART, and that most subjects with ulcero necrotizing periodontal disease had low T-CD4+ counts and a high viral load, despite being on HAART.[10]

Brito et al. (2008)11 explored periodontal conditions in HIV-infected Venezuelan patients on antiretroviral therapy and found that periodontal tissue changes in HIV-infected patients are similar to those observed in those without HIV and those with and without HAART intake.[11]

While some studies observed that ART was associated with a decrease in the prevalence of periodontitis [3,12-18] in HIV-positive patients, others found no significant difference between patients under treatment and those without treatment.[4-6]
Rao, K. V. S, et al. (2015)15reported a significant reduction in the occurrence of periodontal disease after administering ART and that periodontitis decreased after ART implementation. The study by Souza, A. et al. (2017)[14] highlighted the association between the time of use of antiretroviral drugs and the presence of periodontitis, gingivitis and T-CD4+ cell count, i.e. the longer the time of treatment with ART, the lower the presence of periodontitis and gingivitis.

Ntolou et al (2023),[1] in summary, observed that in adult patients, antiretroviral therapy has a protective factor on the prevalence of ulceronecrotizing gingivitis with a 95% confidence interval and a $p < 0.042$, in contrast, in ulceronecrotizing periodontitis, the use of HAART did not seem to affect the prevalence: 95% confidence interval and a $p = 0.321$, it was also seen that HAART did not seem to affect the prevalence of periodontitis, 95% confidence interval and $p = 0.248$ according to clinical parameters such as probing depths found: 95% confidence interval [-0.52, 0.53]; $p= 0.985$, and clinical attachment level 95% confidence interval [-0.19, -0.82]; $p = 0.22$.

Clinical periodontal parameters in HIV-positive patients and antiretroviral therapy

The results of the systematic review by Panagiota Ntolou, (2022)[1] showed that ART can improve the

periodontal status of patients with HIV/AIDS and is associated with a decrease in the prevalence and severity of periodontal disease, although it remains a controversial issue. In addition, ART was also associated with a decrease in clinical attachment loss and an improvement in plaque index.

Brito et al. (2008) [11] evaluated periodontal indices such as plaque index (PI), gingival index (GI), clinical attachment loss (CAL) in HIV-positive patients receiving HAART and HIV without HAART; they observed that there were no significant differences, except for the plaque index, which was higher in the control group. HIV-positive patients receiving HAART had slightly higher GI scores than those without treatment. All patients showed some form of periodontal disease, with predominance of chronic generalized periodontitis, there was predominance of subgingival microorganisms such as P. intermedia which was the most frequently found microorganism in all groups with higher preponderance in HIV positive patients not taking HAART and in the control group, followed by A. actinomycetemcomitans and P. gingivalis which was found mostly in the control group than in HIV positive group under HAART and HIV positive group not taking HAART. [11]

Other authors sharing the findings of Jhon et al,3 are Khammissa et al. (2012),[19] who also found no association between HIV serostatus and periodontal indices such as pocket depth, gingival margin recession, plaque index and bleeding index. HIV-positive and control patients with chronic periodontitis showed similar averages in these indices. For pocket depth, HIV-positive patients who had not received HAART was slightly higher than in those who were taking HAART, when comparing mean pocket depth and T-CD4+ T-cell count, the relationship between T-CD4+ T-cell count and these periodontal indices was not significant. It was also observed that the CD4+ T-cell count was higher in the group of subjects who had received HAART than in those who were not using HAART.[19]

The investigation by Fricke et al. (2012)[12] focused on the periodontal status of HIV-positive patients on ART compared to those without prior HIV treatment; it had a significant influence only on the parameter clinical attachment level. Regarding oral hygiene behavior, no significant differences were detected between the groups. Periodontitis was diagnosed in about 70% in both groups, but there were no differences in the parameters periodontal screening index (PSI), CAL and decayed filled and missing teeth (COP) between the groups. However, papilla bleeding score (PBS) values were higher in the no HAART group compared to the HAART group.

Periodontal treatment in HIV-positive patients on antiretrovirals

Rozra et al. (2012)[4], looked at the distribution of the community periodontal treatment need index score (CPITN). They analyzed a group A (T-CD4+ < 200) and a group B (T-CD4+ was > 200). CPITN score 2 dealing with the presence of supra- or subgingival calculus was the most prevalent (46.2%), with a higher percentage in men (51.4%) than in women (39.3%). The CPITN score 3 and 4 where there are already pathological pockets 4 or 5 mm and 6mm or more respectively, was seen in 20.8% of the total patients. A significant association was also found between CPITN score 3 and 4 and those with a low T-CD4+ cell count. Finally, these authors evidenced that the percentage of patients with periodontitis was higher among those with a T-CD4+ cell count < 200 (31.9%) compared to those with a T-CD4+ cell count > 200 (14.5%).[4]

In addition, the study by Valentine et al. (2016)[13] addressed the impact of periodontal intervention on local inflammation, periodontitis in HIV patients, offering insights into how dental care may influence the course of periodontal disease. The results indicated that the management and improvement of periodontal disease in HIV-positive patients may be influenced by factors such as ART,

proinflammatory cytokine levels, and intervention with non-surgical mechanical therapy at the outset. Based on the measurement of clinical attachment levels the study showed no significant differences before and after the non-surgical mechanical therapy intervention. Throughout the study there is evidence of improvement in periodontal disease as measured by the gingival bleeding index after non-surgical mechanical therapy. As for the association with ART and severe periodontal disease showed no improvement in the groups that were not receiving ART, while in those who received long-term ART achieved virological suppression and showed improvement in periodontal disease. This periodontal improvement was also associated with an increase in T-CD4+ T-CD4+ count in the group taking long-term ART. Moreover, it was observed that periodontal intervention with mechanical therapy resulted in an overall decrease in IL-6 levels, meaning an improvement in oral inflammation.[13]

Antiretroviral therapy and oral status in adult patients with HIV/AIDS

The literature refers that the prevalence of oral manifestations depends in part on receiving or not receiving antiretroviral therapy, Tappuni, AR and Fleming, GJP (2001)[7] Eyeson, JD et al. (2002)10 Nicolatou-Galitis, O. et al. (2004),[8] Hamza, OJ et al. (2006),[9] Brito, A. et al. (2008),[11] Mthethwa, SR et al. (2013)[18] Sharma, G. et al. (2006).[20]

Tappuni et al (2001)[7] examined the effect of antiretroviral therapy on the prevalence of oral manifestations in HIV patients when taking single or dual antiretroviral therapy (ART), with 3 or more drugs (HAART) and when not taking it; patients with some antiretroviral treatment showed fewer oral lesions compared to untreated and those patients who received dual therapy had fewer oral manifestations compared to those who received nothing or received monotherapy. The most common oral lesions detected in the ART or HAART group were erythematous candidiasis which had a prevalence of 11%, chronic periodontitis 8%, oral hairy leukoplakia 4% and ulcerative necrotizing gingivitis 2%; while in the non-ART group, the most frequent were: erythematous candidiasis with a prevalence of 21% oral hairy leukoplakia 11%, ulcerative necrotizing gingivitis 8% and chronic periodontitis 6%.[7]

The studies by Moodley et al. (2015),[16] Patil N, et al. (2015),[17] and Rao K.V.S et al. (2015)[15] share the focus of investigating the relationship between antiretroviral therapy (ART) and periodontitis in individuals with HIV infection. Moodley, A et al (2015),[16] observed that the prevalence of oral lesions in HIV patients is lower in those receiving ART compared to those not receiving ART showing that therapy favors the reduction of HIV-associated oral manifestations. Patil, N., et al. (2015)[17] showed that those patients with higher T-CD4+ T-cell counts tend to have a lower prevalence of oral lesions and ART treatment lower presence of periodontitis and gingivitis.

Nicolatou-Galitis et al. (2004)[8] conducted a study in Greece where they compared the dual ART group, HAART and the group receiving no ART observed that the latter had a low T-CD4+ count and the high viral load, thus manifested more oral lesions, most commonly oral candidiasis both pseudomembranous and erythematous. In contrast, in the double ART group and the HAART group the most common lesion was oral candidiasis. Hamza et al. (2006)[9] found that with HAART the most common oral lesion was oral candidiasis followed by mucosal hyperpigmentation, enlargement of the parotid gland and Kaposi's sarcoma; while in children the most common lesions found were parotid gland enlargement, followed by oral candidiasis, Kaposi's sarcoma, oral hairy leukoplakia, herpes simplex lesions and oral warts.

Oral and periodontal status in HIV-positive pediatric patients on antiretroviral therapy

On the other hand studies covering the pediatric population such as the study by Baghirath et al. (2013)[21] identified oral lesions associated with HIV and its treatment such as linear gingival erythema and hairy leukoplakia that were only observed in HIV positive patients who were without antiretroviral therapy, while HIV-related systemic diseases were significantly associated with the presence of lesions, suggesting that there is an interrelationship between systemic diseases and manifestations in the oral cavity. In addition, socioeconomic status, duration of HIV infection, T-CD4+ cell count and antiretroviral treatment were identified as the best predictors of the presence of HIV-related oral lesions.[21]

Other studies such as Bosco and Birman (2002)[22] did not specify the indices they used to determine gingivitis and periodontitis, they found that gingivitis was only prevalent in children with moderate to severe suppression with an OR = 3.11, 95% CI 1.62-5.97, p = 0.001, this same author (2002),[22] Bosco et al. (2003)[23] and Cerqueira et al. (2010),[24] observed that cervicofacial lymphadenopathy was present in 40% of children, nonspecific gingivitis in children with moderate to severe suppression and was the most commonly observed oral manifestation in their studies, candidiasis and other yeasts were found mostly in patients with severe suppression with 71. 4% and 28.7% of children with moderate suppression; enlargement of the parotid glands was observed more in cases with severe suppression and ulcerations in 3.33% of children, indicating that in children with AIDS patients not receiving antiretroviral therapy HAART present more severe oral complications. They also observed that there is a correlation between the presence of *Candida* and dental caries lesions, where children with yeasts had more caries lesions, and that in the absence of antiretroviral treatment there was more *Candida* proliferation.

Divakar et al. (2015)[25] as well as Bosco et al. (2003)[23] and Cerqueira et al. (2010)[24] found that oral mucosal lesions were more present in those patients not receiving antiretroviral therapy (ART) compared to those receiving ART. In addition, socioeconomic status, duration of HIV infection, presence of HIV-related systemic disease, T-CD4+ T-cell count, and ART treatment also influenced the presence of oral lesions. Those patients who did not receive ART had a 5.634-fold increased risk of developing oral lesions compared to those who did receive ART; Pomarico et al. (2009)[26] revealed that HIV-positive children had significantly elevated levels of total IgA and Candida-specific IgA compared to their HIV-negative siblings. In addition, higher saliva levels of total IgA and Candida-specific IgA were observed in unmedicated subjects compared to those on antiretroviral therapy and Subramaniam et al. (2015)[27] evaluated IgA levels in the saliva of HIV-infected children, dividing them into two groups: those before the initiation of antiretroviral therapy and those who received antiretroviral therapy for more than 3 years; he observed a significant difference in saliva IgA levels between children taking antiretroviral drugs and those not taking antiretroviral drugs. Children without caries had lower levels of salivary IgA compared to children with dental caries.

Ponnam et al. (2012),[28] found several oral lesions in HIV-positive children, both in those receiving HAART and those not receiving HAART. These lesions were: candidiasis, which was more common in HIV-positive children without HAART than in those receiving treatment, ulcerative stomatitis more frequent in HIV-positive children without HAART compared to those receiving HAART, dental caries whose prevalence was similar in both groups of HIV-positive children, gingivitis and periodontitis, lesions that were more frequent in HIV-positive children without HAART than in those on treatment, and finally hyperpigmentation which was found more frequently in HIV-positive children receiving HAART.[28]

In addition, manifestations in HIV-positive children on HAART were compared with HIV-negative children. In this comparison, dental caries and gingival/periodontal lesions were more frequent in HIV-positive children on HAART compared to HIV-negative children.[28]

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However, the meta-analysis indicated a higher prevalence of gingivitis in children with moderate to severe suppression, with an OR = 3.11, 95% CI 1.62–5.97, $p = 0.001$. The manifestations that were found with the highest prevalence were recurrent oral ulcers, with an OR = 6.83; 95% CI 1.18–39.53; $p < 0.001$, oral candidiasis with an OR = 16.94; 95% CI 5.06–56.70; $p < 0.001$, and hyperpigmentation (OR = 20.35; 95% CI 3.86–107.39; $p < 0.001$; $I^2 = 0.0\%$, $p = 0.784$).[2]

CONCLUSIONS

According to the most recent literature, it has been shown that antiretroviral therapy positively influences the oral manifestations associated with HIV in pediatric patients, reducing their prevalence. In the adult population, the efficacy of highly active antiretroviral therapy (HAART) showed only significant results in necrotizing gingivitis and oral manifestations, considering that the evidence does not record studies of rigorous design such as clinical trials, only observational studies.

It is suggested that the use of HAART in patients with HIV could decrease the prevalence of periodontitis, indicating that it has an effect on CD4 cells and therefore could impact the development of periodontal disease, as well as microbiological and viral parameters at the periodontal level.

LIMITATIONS OF THE STUDY

The lack of controlled clinical trials limits the ability to obtain conclusive results. The need for more research is highlighted in order to better understand the precise mechanisms behind the observed effects.

CONFLICT OF INTERESTS

The development and analysis of this study present no conflict of interest.

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