

# Correlation between CD4 Count and Dental Caries in HIV-seropositive Children Undergoing Antiretroviral Therapy

Monica Mohanram<sup>1</sup>, Madan Kumar PD<sup>2</sup>

## ABSTRACT

**Background:** India has the third-largest HIV epidemic in the world. According to the UNAIDS Gap report 2016, 2.1 million people were living with HIV and approximately 43% of Indian adults with the virus have access to antiretroviral treatment. Even though antiretroviral therapy (ART) use has reduced the prevalence of oral manifestations, there is an increase in the prevalence of dental diseases, mainly due to the chronic influence of some factors involved in the process of HIV infection. Among them are the prolonged use of sugary products, changes in salivary flow, etc. The aim of the present study was to assess the association of CD4 count with dental caries in HIV-seropositive patients receiving ART.

**Methods:** A descriptive study was conducted. Demographic details and recent CD4 counts were recorded. For dental caries, the decayed, missing, filled teeth (DMFT) index was used. Data were analyzed using SPSS version 20. Pearson correlation was used to correlate CD4 count with dental caries.

**Results:** Caries showed a strong positive correlation of 1.0 but were not found to be statistically significant ( $p$ -value = 0.8).

**Conclusion:** The study findings showed that there is a close relationship between oral health and general health in children living with HIV, and it highlights the significance of advocate policies on oral health among children living with HIV.

**Keywords:** Cross-sectional study, Dental caries, DMFT, HIV.

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## INTRODUCTION

HIV is still a leading public health crisis all over the world. The world's third-largest HIV epidemic is concentrated in India, and the global HIV prevalence is 0.8% among adults. In 2018, out of 37.9 million people living with HIV, 36.2 million were adults and 1.7 million were children. Globally, 23.3 million people living with HIV (62%) are accessing antiretroviral therapy (ART).<sup>1</sup>

The cluster of differentiation 4 (CD4+) T lymphocytes serve as a major factor in immune system maturation. HIV infection results in a gradual decrease in the CD4+ T lymphocytes level,<sup>2</sup> leading to a disturbance in the homeostasis and immunity against microbes.<sup>3</sup>

Replication of HIV that occurs in the gastrointestinal tract will lead to a huge reduction in CD4 T-cells during the initial 3–6 weeks of infection. In spite of being treated with ART for years, CD4 T-cells have limited recovery only.<sup>2</sup> Almost each and every part of the body is damaged in the sequence of HIV infection.<sup>4</sup> Due to the weakening of mucosal immunity in the HIV infection, the oral cavity defense also weakens, resulting in the multiplication of habitual oral flora colonies.<sup>3,5,6</sup>

In the course of HIV infection, *Streptococcus mutans* colonies, an important microbe for dental caries development, multiplied significantly.<sup>7</sup> Studies have detected *Streptococcus* species in a supragingival plaque of HIV-infected population more commonly than in populations without HIV infection.<sup>8</sup> According to a study by Damle et al., cariogenic microbes, such as mutans streptococci and lactobacilli levels, correlated with the status of HIV among HIV-infected children.<sup>9</sup>

In India, HIV is mainly transmitted through vertical route from mother to child.<sup>10</sup> Children who are vertically infected present

<sup>1,2</sup>Department of Public Health Dentistry, Ragas Dental College, Chennai, Tamil Nadu, India

**Corresponding Author:** Monica Mohanram, Department of Public Health Dentistry, Ragas Dental College, Chennai, Tamil Nadu, India, Phone: +91 9600047692, e-mail: gurupriya.monica@gmail.com

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underweight and delayed milestones, such as delay in dental eruption, lesser permanent teeth, retained primary teeth, and certain dental anomalies due to under-developed immunity.<sup>11,12</sup> According to the National Oral Health Survey (2002–2003), the decayed, missing, filled teeth (DMFT) index score was 2 for Indian children, and the prevalence of caries was increasing with age from 51.9 to 63.1% in 5 to 15 years of age-group, respectively.<sup>13</sup> Dental caries prevalence tended to have an annual increase among children living with perinatal HIV/AIDS (CLWPHA), which may be due to the immune suppression by HIV/AIDS.<sup>14</sup>

Even though the prevalence of HIV oral manifestations has been decreased by the improvement in ART, the dental disease prevalence has increased because of certain factors related to the HIV infection. The factors include immunosuppression, chronic use of ART drugs rich in sugar content, the difference in the flow of saliva due to certain drugs, carbohydrate-rich diet, recurrent hospitalization, and compromised oral care.<sup>15</sup>

There may be a reduction in salivary flow rate and alteration in habitual oral flora due to the infiltration of HIV and CD8 proliferation in salivary glands<sup>16</sup> together with highly active antiretroviral therapy (HAART) usage; therefore, they are considered to be the main factors resulting in dental caries in HIV-infected patients.<sup>17</sup>

Since dentition and oral cavity are crucial for digestion and ingestion of nutrients, dental caries among the HIV population alter the ingestion of nutrients leading to nutrition deficiency which in turn makes the immune suppression even poorer.<sup>18</sup>

The aim of the present study was to assess the correlation between CD4 count and dental caries among CLWPHA under HAART.

## MATERIALS AND METHOD

### Ethical Clearance

This cross-sectional study was conducted following approval by the Ethical Committee, Ragas Dental College and Hospital, Chennai. The general guidelines to ensure the rights of participants were followed. Before the investigation, parental or guardian consent was obtained, and the study information was reaffirmed orally.

### Participants

The sample size was calculated according to previously reported data, suggesting an overall HIV prevalence rate of about 0.2% in the Indian general population, using a power of 80%. G power (version 3.1) software was used for sample size calculation.

It was estimated that 35 patients would be required. The convenient sampling was used to include 35 HIV-positive adolescents from an institutionalized set-up at Chennai.

The sample was diverse in nature pertaining to gender, ethnicity, sexual orientation, socioeconomic status, and education.

### Inclusion Criteria

- Adolescents aged 12 to 18 years of age diagnosed with HIV infection with vertical transmission as the route of infection and under HAART, at least for the past three years with CD4 count >200 cell/mm<sup>3</sup>, who never had a clinical AIDS-defining symptom.
- Adolescents who agreed to participate and whose parents or guardian gives consent. Consent was also obtained from the Head of the Institution.

### Exclusion Criteria

Adolescents with chronic medical conditions or mental health disorders that would prevent informed consent.

### Materials and Method

Data collection was done in two phases for HIV-infected adolescents.

#### CD4 Level

In the first phase, participants' HIV status was verified (e.g., HIV clinic card or HIV medication prescription), and the demographic data and CD4 level of each participant for the past 6 months were collected retrospectively from their respective medical records that served as the secondary data.

#### Dental Caries Assessment

In the second phase, dental caries examination was performed for the same participants who were physically present at the field setting under natural light. DMFT index being the most simplest

and valid instrument was used to assess dental caries in permanent teeth, which served as the primary data.

Apart from the study, comprehensive dental treatment was also provided for the participants focusing on preventive measures, and the participants were advised regular dental check-ups every 3 months.

### Statistical Analysis

Data collection and management were conducted using the Microsoft Office Excel package in association with the SPSS 20.0 software package (SPSS Inc.) for the statistical analysis. Data analysis was done using descriptive statistics. Categorical variables are presented as percentages or proportions. Continuous variables are expressed as means and standard deviations. CD4 count was correlated with dental caries using Pearson correlation.

## RESULT

The study included 35 participants [male  $n = 14$  (40%) and female  $n = 21$  (60%)] aged 12 to 18 years with a mean age of  $14.83 \pm 2.20$  years. CD4 count was between 249 and 1367 cells/mm<sup>3</sup>. The mean CD4 count was  $713.86 \pm 295.37$  cells/mm<sup>3</sup>. DMFT scores ranged from 0 to 7, and the mean DMFT was found to be  $1.83 \pm 1.83$ . Dental caries prevalence was found to be 71.4%. Comparison of DMFT score between study participants according to CD4 count is presented in Table 1.

CD4 count and caries showed a strong positive correlation of 1.0 but was not statistically significant ( $p$ -value = 0.8) (Table 2).

## DISCUSSION

Progressive immunosuppression due to HIV infection decreases the flow rate of saliva and alters the habitual oral flora, leading to the development of dental caries in HIV-infected patients. Reduced salivary flow due to some sucrose-based ART drugs can also promote dental caries.<sup>19</sup>

Oral care is the most important component in overall care for people living with HIV infection.<sup>9</sup> Poor dentition can negatively influence the quality of life, impede the treatment of certain medical conditions, and aggravate psychosocial problems if present.<sup>20</sup>

**Table 1:** Comparison of DMFT score between study participants according to CD4 count

CD4 count (cells/mm <sup>3</sup> )	n (%)	DMFT score (Mean $\pm$ SD)	DMFT score Range
200–500	10 (28.6)	1.7 $\pm$ 1.8	0–5
500–1000	19 (54.3)	2.2 $\pm$ 1.9	0–7
>1000	6 (17.1)	1 $\pm$ 1.2	0–3

**Table 2:** Correlation between CD4 count and DMFT score

		CD4 count	DMFT score
Pearson correlation	Correlation coefficient	1	0.028
CD4 count	Sig. (2-tailed)		0.873
	N	35	35
DMFT score	Correlation coefficient	0.028	1
	Sig. (2-tailed)	0.873	
	N	35	35

Relation between dental health and the status of immunity among children living with HIV remains unclear. Dental caries prevalence in our study showed a high prevalence of 71.4% in HIV-positive children. This was similar to the earlier survey in Iran, which showed that the dental caries prevalence was high among people living with HIV.<sup>21,22</sup> This result was in contrast to the findings in a study in Bengaluru, India, that demonstrated that the prevalence of dental caries was low among children living with HIV.<sup>15</sup>

We found a strong positive correlation between the DMFT score and the CD4 cell count, but it was not statistically significant. These observations suggest that poor oral is associated with an improved immunity. This was similar to a study conducted in Nigeria, which found a correlation between the prevalence of dental caries and immunosuppression degree in children living with HIV.<sup>23</sup> Our study results were also in line with the study done by Hicks et al., which concluded that caries presence in HIV-infected children increases with decreasing CD4 count.<sup>24</sup> Contrastingly, in a study by Beena et al., dental caries prevalence was high with a severe degree of immunosuppression.<sup>22</sup> The fundamental process may be because of an increase in cariogenic oral bacteria due to HIV-induced suppression of the immune system.<sup>24</sup> But our study findings have shown the converse; that is, oral health affects overall health.<sup>25</sup>

Compromised oral health in HIV-infected patients alters the nutrition intake since teeth and oral cavity play an important role in digestion and nutrition that can in turn result in nutrition deficiency, which suppresses the immune system.<sup>26,27</sup> Children infected with HIV have poor nutritional status compared to healthy children. Hence, children living with HIV are more prone to disturbance in salivary gland development and its consequent compromised oral health status.<sup>28</sup> Thus, oral health and overall health are interlinked.

## LIMITATION

We were not able to prove the causality due to its cross-sectional design. The tooth brushing frequency, knowledge of oral health, and diet history that might affect the caries experience were not recorded. Alteration in oral flora and the influence of HIV on the oral microbes among the participants were also not examined. Hence, further studies are recommended to identify the dental caries risk factors in this population. Inherent sampling bias could have been possible since a single-center setting was used. The sample size was another limitation.

## CONCLUSION

Surprisingly, CD4 counts positively correlated with dental caries in our study. The study findings showed that there is a close relationship between oral health and general health in children living with HIV, and it highlights the significance of advocate policies on oral health among children living with HIV.

Promotion regarding oral hygiene is recommended among this population to improve their oral health. Future studies to determine the effect of oral health on the immune system of the HIV-infected populations are needed.

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