

## Gingival status of HIV+ children and the correlation with caries incidence and immunologic profile

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### Abstract

**Purpose:** *The aim of this study was to determine gingival health and caries levels in HIV-infected children.*

**Methods:** *The modified gingival index (GI) of 43 HIV+ children of both sexes, aged between 2 and 12 years, was measured and correlated with the DMFT/dmf. The children's immunodeficiency level was also established by means of the CD4:CD8 ratio. Pearson's product-moment correlation coefficient and the Mann-Whitney U test were used.*

**Results:** *The GI was significantly related to the DMFT/dmf. The children with a GI = 0 presented significantly more DMFT/dmf than the children with a GI  $\geq$  0.1, but there were no significant differences between the GIs of caries-free children and those with DMFT/dmf  $\geq$  1. The children who presented a CD4:CD8  $\geq$  0.5 ratio presented less DMFT/dmf compared with children who presented a CD4:CD8 < 0.5 ratio. The children who presented a CD4:CD8 < 0.5 ratio presented a statistically significant correlation between their GI and their DMFT/dmf, unlike children who presented a CD4:CD8  $\geq$  0.5 ratio. Children with a CD4:CD8 < 0.5 who showed a greater DMFT/dmf index also showed greater gingival inflammation.*

**Conclusions:** *In this study, children with greater caries experience showed more gingival inflammation. In addition, a greater immunological deficiency might indicate a greater caries experience in children. (Pediatr Dent 20:169-72, 1998)*

Few studies describe the gingival health of HIV-infected children. Linear gingival erythema, necrotic ulcerative gingivitis, and necrotic ulcerative periodontitis are among the lesions which are strongly related to HIV infection.<sup>1</sup> Severe periodontal manifestations do not occur in HIV+ children.<sup>2,3</sup> However, Soubry et al.<sup>4</sup> reported 84 cases of necrotizing periodontal disease in HIV-infected children in Kigali, Rwanda. There were 44 cases of necrotizing gingivitis, 26 of necrotizing periodontitis, and 14 of necrotizing stomatitis.

Untreated carious lesions or restorations, whether defective or not, may be associated with periodontal bone support loss, which is noticeable as early as the third decade.<sup>5</sup> Some research has noted a higher caries

incidence in HIV+ children compared with uninfected children in the same age group,<sup>6</sup> so it is possible that there is also a potential effect on the gingival health of infected children as a result of treated or untreated dental caries.

The aim of our investigation was to determine the gingival health and caries levels in HIV+ children. The modified GI was measured and correlated with the DMFT/dmf and immunologic profile of the children.

### Methods

The research plan was approved by the University's Committee on Research involving human subjects, and written consent was obtained. From October 1995 to February 1996, all HIV-infected children attending the Outpatient Clinic of Infectious Diseases and Immunology of the Martagão Gesteira Child Health Institute of the Federal University (IPPMG/UFRJ), Rio de Janeiro, Brazil, were examined to determine their gingival health and caries levels. Seropositivity was defined as repeatedly positive ELISA (HIV) confirmed by Western blot. Forty-three HIV+ children of both sexes, between 2 and 12 years of age, participated in the study. The children were classified according to the stage of development of the disease following the criteria of the Centers for Disease Control and Prevention (CDC).<sup>7</sup>

All the GIs were determined by the same trained and calibrated examiner (ARV), using a mouth mirror, gauze, and a periodontal probe, after removing dental plaque with a toothbrush and fluoridated dentifrice. Inter-rater reliability was determined prior to the study by comparison with another experienced and previously calibrated examiner (AM). Training included several didactic sessions reviewing standard diagnostic criteria, as well as clinical examinations of 10 children. Intrarater reliability was determined by re-examining nine patients without the examiner's knowledge during the study. The criteria described by Loe and Silness<sup>8</sup> were used, with alterations to the number of teeth and dental surfaces to be examined. Only the distal surface of primary canines and the mesial surface of primary

first molars were examined. When one of these teeth had already exfoliated or was about to, there was advanced mobility, or the permanent canine or the first premolar had not yet erupted or had not erupted completely, the tooth was not considered. If the permanent canine or first premolar had erupted completely, they were used.

The examined dental surfaces were given scores, according to the following criteria:

1. **0 normal gingiva**
2. **1 mild inflammation:** slight change in color, slight edema, no bleeding on probing
3. **2 moderate inflammation:** redness, edema and glazing, bleeding on probing
4. **3 severe inflammation:** marked redness and edema, ulceration, tendency to spontaneous bleeding

The index for gingival inflammation was the sum of the scores divided by the number of teeth:  

$$\text{sum of scores} = \text{GI} \div \text{number of teeth}$$

The DMFT/dmf index was determined by a trained and calibrated examiner (GFC) using a mouth mirror, gauze, and probe. Inter-rater reliability was determined prior to the study by comparing with another experienced and previously calibrated examiner (IPRS). Training included several didactic sessions reviewing standard diagnostic criteria, and clinical examinations of 10 children. Intrarater reliability was determined by reexamining nine patients without the examiner's knowledge during the study. Only cavities extending to dentin were included in the caries indices (d/D).

The children were assorted by the CD4 lymphocyte percentage, which was adjusted for children younger than 6 years of age.<sup>7</sup> The parameter used to correlate the immunological state with gingival inflammation and the DMFT/dmf index was the CD4:CD8 ratio. Children with CD4:CD8 values  $\geq 0.5$  were considered to be less affected immunologically, and those with a CD4:CD8 ratio of  $< 0.5$  were considered to be more affected. Both examiners were blinded to a child's CD4:CD8 ratio during examinations.

Pearson's product-moment correlation coefficient ( $r$ ) was used to show any dependencies between variables, and the Mann-Whitney  $U$  test was used for analyzing differences between the groups. Values of  $P < 0.05$  were considered statistically significant.

## Results

Forty-three children, 24 males and 19 females, between 2 and 12 years old (mean, 6.32) were examined. In 81% of the cases ( $N = 35$ ), HIV was vertically transmitted. The distribution of the children according to disease stage, as per the CDC criteria<sup>7</sup> is given in Table 1.

The values found for the examined children's GIs are given in Table 2. In eight cases it was not possible

to evaluate all the teeth to determine the GI, as one or more had already exfoliated or were about to. In these cases, only the teeth available provided the gingival index. In four cases the permanent canine and/or first premolar were considered for determining the gingival index. The mean GI was 0.64 (SEM = 0.09).

The average DMFT/dmf was 5.67 (SEM = 0.82). The GI was significantly correlated to DMFT/dmf ( $r = 0.34$ ;  $P \leq 0.05$ ). To further analyze the data, the children were initially divided into two groups. The first was made up of children with GI = 0 ( $N = 14$ ); the second included children with a GI not equal to zero ( $\text{GI} \geq 0.1$ ;  $N = 29$ ). The DMFT/dmf values were compared statistically and the data showed a significant difference ( $P = 0.0336$ ) between the GI = 0 (mean DMFT/dmf = 3.28; SEM = 0.96) and the GI  $\geq 0.1$  groups (mean DMFT/dmf = 6.82; SEM = 1.07). Children with GI = 0 had lower DMFT/dmf ratios than children with GI  $\geq 0.1$ .

Another comparison was made by separating the children according to caries experience. Children with a DMFT/dmf = 0 ( $N = 9$ ) had their GIs compared with those of children with a DMFT/dmf  $\geq 1.0$  ( $N = 34$ ). There were no statistically significant differences ( $P = 0.1335$ ) between the children with a DMFT/dmf = 0 (mean GI 0.44; SEM = 0.14) and DMFT/dmf  $\geq 1.0$  (mean GI 0.70; SEM = 0.11).

It was possible to obtain CD4 and CD8 lympho-

**TABLE 1. DISTRIBUTION OF THE 43 CHILDREN ACCORDING TO DISEASE STAGE\***

Disease Stage	Number of Cases (%)
N	1 (2.33)
A	9 (20.93)
B	10 (23.25)
C	23 (53.48)

\* Patients of IPPMG/UFRJ - Rio de Janeiro, Brazil.

**TABLE 2. GINGIVAL INDEX (GI) OF THE 43 CHILDREN\***

GI	Number of Children
0	14
0.1-1.0	20
1.1-2.0	8
2.1-3.0	1

\* Patients of IPPMG/UFRJ - Rio de Janeiro, Brazil.

cyte counts of 34 children. Eleven children (32%) presented a CD4:CD8  $\geq 0.5$  ratio and 23 children (68%) presented a CD4:CD8  $< 0.5$  ratio.

The GI of children with a CD4:CD8  $\geq 0.5$  ratio (mean 0.46; SEM = 0.14) was compared with those of children with a CD4:CD8  $< 0.5$  ratio (mean 0.84; SEM = 0.13), with no statistically significant differences ( $P = 0.0571$ ). However the comparison DMFT/dmf of children with a CD4:CD8  $\geq 0.5$  ratio (mean 2.81; SEM = 0.93) with those of children with a CD4:CD8  $< 0.5$  (mean 8.34, SEM=1.20) presented a statistically significant difference ( $P = 0.0026$ ). Children with a CD4:CD8  $\geq 0.5$  ratio had fewer caries than children with CD4:CD8  $< 0.5$ .

There was no statistically significant correlation between GI and DMFT/dmf ( $r = 0.29$ ;  $P > 0.05$ ) in children with a CD4:CD8  $\geq 0.5$  ratio. However, there was a significant correlation ( $r = 0.54$ ;  $P \leq 0.01$ ) between GI and DMFT/dmf in children with a CD4:CD8  $< 0.5$  ratio. Children with a CD4:CD8  $< 0.5$  who showed a greater DMFT/dmf index also showed greater gingival inflammation.

## Discussion

Gingivitis in HIV+ children has already been described by a few researchers. Moniaci et al.,<sup>9</sup> who studied oral manifestations in 69 HIV+ children, found two cases of gingivitis (10%). Valdez et al.<sup>6</sup> reported a 8% incidence of what has been classified as moderate gingivitis, and a 40% incidence of mean gingivitis. Because the criteria used for determining the presence of gingivitis in these two studies and ours were different, it was not possible to compare them.

Some studies do not show differences in gingivitis between HIV+ children and uninfected children over time. However, HIV+ children have shown a greater accumulation of plaque and a greater propensity to linear gingival erythema.<sup>3, 10, 11</sup>

Shoen et al.<sup>3</sup> compared the gingival health of 100 HIV+ children and 87 uninfected children and showed that bleeding upon probing was similar in both groups. There was no incidence of advanced periodontal disease in either group, and the occurrence of gingivitis in both groups was 39%. Weddell and Klein's<sup>12</sup> studies with uninfected children showed an incidence of advanced periodontal disease of 13% in children aged 6 to 17 months, 34% in children aged 18 to 23 months, and 39% in children aged 24 to 36 months. Carter and Wells,<sup>13</sup> who examined 29 500 children aged 6 to 12 years, found a median gingivitis incidence of 50%. The present study showed that 33% of the HIV+ children examined ( $N = 14$ ) presented no detectable gingival alterations (Table 2), with nine cases of gingiva with a tendency to bleed upon stimulation ( $N = 8$ ) or with a tendency to spontaneous bleeding ( $N = 1$ ). Twenty-nine children (68%) presented some

gingival alteration, expressed by a GI  $> 0.1$  ( $N = 29$ ). Comparison with the above mentioned studies is not possible because the evaluation methods used were not similar.

Albandar et al.<sup>5</sup>, who studied 13 years olds for 3 years, showed that there is a significant association between the presence of untreated carious lesions and the presence of restorations, whether defective or not, with bone loss. The proximal dental surface appears to be the area that suffers the greatest loss of periodontal support because local irritating factors are easily accumulated in this area. Based on this concept, the modification of the GI proposed by L e and Silness<sup>8</sup> for the inspection of only a few proximal areas is justified, because these areas usually present factors which predispose to local inflammation of the periodontium. Bimstein and Garcia-Godoy<sup>14</sup> report that an early diagnosis of alveolar bone loss is necessary, because it is already visible in the primary dentition. These authors found that one of the main causal factors of bone loss was caries.

In our study, children with a GI = 0 had significantly fewer caries than children with a GI  $> 0.1$ . This might suggest that a greater presence of caries would indicate poorer gingival health. This is corroborated by the statistically significant relation between GI and DMFT/dmf. The comparison of the GI values for caries-free children with those of children with a DMFT/dmf  $\geq 1.0$  was not statistically significant in this study, which may be due to the small number of caries-free children.

Valdez et al.<sup>6</sup> has suggested that the higher prevalence of caries in HIV+ children in comparison with HIV- children in the same age group may be due to AIDS-related factors. These factors included socioeconomic and medical status, and long-term use of pediatric medications. HIV-infected children are typically treated with antivirals, antibiotics, and antifungals. In addition, hypernutrition therapy, particularly as the disease progresses, may influence the development and progression of caries.

Madigan et al.<sup>15</sup> demonstrated that a more advanced disease stage had a higher caries prevalence. In our study, children with a CD4:CD8  $< 0.5$  ratio presented a higher caries incidence than children with a CD4:CD8  $\geq 0.5$  ratio. However, there were no statistically significant differences between the groups concerning the GI. It should be noted that the error probability found in the statistical analysis was very close to 5% and the analyzed sample was very small. Howell et al.<sup>16</sup> reported that the CD4 counts/mm<sup>2</sup> were different between children with healthy gingiva and children with gingivitis, linear gingival erythema, and periodontitis. Children with healthy gingiva had higher CD4 counts/mm<sup>2</sup> than children with some gingival alteration.

There was a statistically significant correlation be-

tween GI and caries incidence in children with a CD4:CD8 < 0.5 ratio, which might suggest that a greater immunological deficiency might indicate a greater caries incidence, and therefore, poorer gingival health. Further studies are necessary to verify the true influence of the immunological status on caries and gingival health.

### Conclusions

1. The HIV+ children studied presented a correlation between caries incidence and gingival inflammation level. A greater DMFT/dmf index was associated to a higher gingival inflammation level.
2. Children more immunologically affected showed a greater DMFT/dmf index.

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