Greater severity and extent of periodontal breakdown in 136 south Indian human immunodeficiency virus seropositive patients than in normal controls: A comparative study using community periodontal index of treatment needs

Ranganathan K1, Magesh KT1, Kumarasamy N2, Suniti Solomon2, Viswanathan R1, Newell W Johnson3

ABSTRACT

Apart from the more or less distinctive forms of periodontal disease associated with human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome there remains considerable uncertainty as to whether or not conventional destructive periodontitis is exacerbated in HIV positive individuals. This is especially so in developing countries, from which few studies have been reported. The present study compared the severity and extent of periodontal breakdown in 136 HIV positive individuals from Chennai, South India, with 136 age-matched controls from the same low socio-economic and ethnic group. All surfaces of all teeth were scored for the community periodontal index of treatment needs (CPITN). Statistical analysis was performed using SPSS™ package. The results of the present study show that CPITN is a simple, useful technique to assess periodontal status in immunosuppressed patients and that periodontitis is associated with immunosuppression and oral candidiasis. The assessment of periodontal status could thus be a useful tool in minimally invasive screening of populations for HIV disease, especially in those parts of the world, like India and Africa, with high prevalence and rising incidence.

Key words: Community periodontal index of treatment needs, human immunodeficiency virus seropositive patients, periodontal breakdown, south Indian

INTRODUCTION

Human immunodeficiency virus (HIV) infection/acquired immune deficiency syndrome (AIDS) is a major global pandemic. The Indian sub-continent with a population of one billion is estimated to have 3-5 million people infected with HIV and National AIDS Control Organization, Government of India (NACO) describes HIV infection as the most serious public health problem facing the nation.[1]

Oral lesions are important in the management of HIV/AIDS patients and also play an important role in the early diagnosis and monitoring of these patients.[2,3] Periodontal changes form an important part of the wide spectrum of oral lesions seen in HIV infection and lesions such as linear gingival erythema, necrotising ulcerative gingivitis and necrotising ulcerative periodontitis are characteristic manifestations in this infection. In 1983 Winkler et al observed an unusually aggressive periodontitis in HIV infected homosexual men in California.[6]

Since then periodontal diseases have been the focus of several studies,[7-9] but there has been little recent progress.[10,11]

At the Fourth International Workshop on Oral Manifestations of HIV infection, it was emphasized that a greater understanding of the nature and severity of periodontal diseases among people with HIV in developing countries is necessary. This information would determine which periodontal lesions had diagnostic and prognostic value in relation to HIV/AIDS and which should be targeted with regards to treatment in the resource-poor regions of the world.[12,13]

Reports on the association between HIV infection and periodontal diseases describe prevalence rates ranging from 1-66% for gingivitis and 0-91% for periodontitis.[5,14-19] This wide variation may be due to differences in selection criteria, degree of immunosuppression, co-morbidity and smoking, for example,[10,19] but especially due to the different criteria used by the investigators to diagnose periodontal disease.[20] Robinson has addressed this latter problem. He discusses in detail the various clinical criteria used by the different classifications for diagnosis of periodontal diseases and suggests
those likely to be useful to assess the periodontal changes in HIV infected patients.\textsuperscript{[21]}

Since periodontal status closely reflects the immune status of an individual, its study is important in HIV infection.\textsuperscript{[22]} Deterioration of the immune system in HIV infection consequent to the depletion of CD4+ T cells adversely affects the host defence in the dento-gingival region and increases susceptibility to periodontal damage.\textsuperscript{[23]} The marked immune deficiency associated with this infection and absence of adequate priming of neutrophils due to a reduced Th1-T lymphocyte response act directly or in concert with sub gingival bacterial pathogens to produce pro-inflammatory cytokines, which increase the occurrence of periodontal damage. As these changes occur early in the course of the HIV infection, periodical assessment of periodontal status could be useful in the management of these patients.

Numerous reports have documented the relationship between immunosuppression and periodontitis; however, there has been no standard means of periodontal assessment in these studies. We have used the established community periodontal index of treatment needs (CPITN) in the present study to both assess and establish baseline values of periodontal status.

The aims of this study were:

1. To ascertain and compare the periodontal status in HIV seropositive and presumed HIV seronegative patients from Chennai, South India, by using a standard periodontal index: CPITN.

2. To ascertain if any correlation exists between CD4+ T cell counts and periodontal status in HIV seropositive patients from Chennai, South India.

**MATERIALS AND METHODS**

136 HIV seropositive patients attending RAGAS-YRG CARE (Center for AIDS Research and Education), Chennai, South India, were enrolled. All attended or were referred because of known or suspected HIV disease. A trained counselor confirmed sources of infection. Confirmation of HIV serostatus for all patients was by enzyme-linked immunosorbent assay (ELISA) (Merind Diagnostics, Belgium) and Western blot (Biotechnology kit, Singapore). CD4 cell counts were performed for 72 patients who could either afford the expense or were funded by projects requiring specific criteria.

136 control patients (presumed seronegative) were recruited from outpatients presenting for routine dental treatment at the Ragas Dental College and Hospitals, Chennai, South India.

As both the institutions serve low income groups within the population, the majority (>90%) of subjects in both case and control groups were from the lower socio-economic strata. Patients with smoking and betel nut/pan chewing habits were excluded from both the groups.

**Methods**

A thorough history was taken. Trained dental surgeons and physicians performed clinical oral and systemic examinations, respectively, and the findings were recorded in as standard format. Clinical diagnosis of oral lesions was based on the criteria established by the EC Clearing House and WHO and as reported by us earlier.\textsuperscript{[5]}

Periodontal Index: The CPITN, as described by WHO and reviewed by Page and Morrison,\textsuperscript{[24]} was ascertained by dental surgeon KT Magesh who had been trained for two months in the Department of Periodontology, Ragas Dental College and Hospital, until his technique was standardized, so as to produce reproducible results. To avoid inter-examiner variations only the author performed these assessments.

**Statistical analysis**

All data were entered into MS\textsuperscript{TM} Access database and analyzed using the SPSS\textsuperscript{TM} package. Mann-Whitney U Wilcoxon Rank sum W test, ANOVA and logistic regression analyses were performed to explore associations; conventional $P$ values of <0.05 were regarded as statistically significant.

**RESULTS**

Table 1 gives the details of the patients and controls. All the 136 patients had acquired the infection through heterosexual contact. 32% complained or an oral problem at the time of initial presentation to the HIV physician. The case and control groups were closely matched for age, though the patient group had a higher proportion of men.

Table 2 lists the systemic and oral lesions in the HIV seropositive patients. Among the seronegative controls 113 (83.1%) had gingivitis and 117 (86%) had periodontitis. There were no cases of linear gingival erythema.

Table 3 shows the number of sextants affected by the different CPITN scores in the study groups. These data were analyzed using Mann-Whitney U Wilcoxon Rank sum test; $P$<0.05 was considered statistically significant.

**Table 1: Age and gender distribution of human immunodeficiency virus seropositive patients and controls**

<table>
<thead>
<tr>
<th>Gender</th>
<th>HIV sero positive</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$n$</td>
<td>Age</td>
</tr>
<tr>
<td>Male</td>
<td>95</td>
<td>28.4</td>
</tr>
<tr>
<td>Female</td>
<td>41</td>
<td>31.1</td>
</tr>
<tr>
<td>Total</td>
<td>136</td>
<td>29.8</td>
</tr>
</tbody>
</table>

$^*$SD - Standard deviation, HIV - Human immunodeficiency virus

\textsuperscript{[21]} Ranganathan, et al.

\textsuperscript{[22]} Indian J Dent Res, 18(2), 2007
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Table 2: Systemic and oral lesions in human immunodeficiency virus seropositive patients

<table>
<thead>
<tr>
<th>Systemic lesions</th>
<th>Number of patients (n=136) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aids-related complex (ARC)*</td>
<td>41 (30.2)</td>
</tr>
<tr>
<td>Pulmonary tuberculosis</td>
<td>28 (20.6)</td>
</tr>
<tr>
<td>Dermatological lesions</td>
<td>16 (11.8)</td>
</tr>
<tr>
<td>Genital ulcers</td>
<td>11 (8.1)</td>
</tr>
<tr>
<td>Cervical lymphadenopathy (non-specific)</td>
<td>8 (6.9)</td>
</tr>
<tr>
<td>Hepato-splenomegaly</td>
<td>2 (1.5)</td>
</tr>
<tr>
<td>Pneumocystis Carinii pneumonia</td>
<td>2 (1.5)</td>
</tr>
<tr>
<td>Toxoplasmosis</td>
<td>1 (0.7)</td>
</tr>
<tr>
<td>Asymptomatic</td>
<td>44 (32.4)</td>
</tr>
</tbody>
</table>

*ARC: Includes group of symptoms - weight loss, loss of appetite, fever, headache, and diarrhea, consequent to the immunosuppression.

Table 3: Number and percentage of sextant affected by different community periodontal index of treatment needs scores in human immunodeficiency virus seropositive and control group

<table>
<thead>
<tr>
<th>HIV status</th>
<th>No. of patients (n)</th>
<th>No. of sextants (nx6)</th>
<th>No. and percentage of sextants that contain the different CPITN scores as highest scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seropositive</td>
<td>136</td>
<td>816</td>
<td>21 (2.6) 24 (2.9) 132 (16.2) 407 (49.9) 231* (28.4)</td>
</tr>
<tr>
<td>Controls</td>
<td>136</td>
<td>816</td>
<td>23 (2.8) 74 (9.1) 241 (29.5) 406 (49.8) 72* (8.8)</td>
</tr>
</tbody>
</table>

*Statistically significant difference, HIV: Human immunodeficiency virus, CPITN: Community periodontal index of treatment needs, Figures in parentheses are in percentage.

Table 4: Number and percentage of sextants affected by different community periodontal index of treatment needs scores in patients with known CD4 counts

<table>
<thead>
<tr>
<th>CD4 status</th>
<th>No. of patients (n)</th>
<th>No. of sextants (nx6)</th>
<th>No. and percentage of sextants that contain the different CPITN scores as highest scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD4 &lt;200</td>
<td>25</td>
<td>150</td>
<td>0 0 25 (16.7) 62 (41.3) 63 (42.0)</td>
</tr>
<tr>
<td>CD4 &gt;200</td>
<td>47</td>
<td>282</td>
<td>7 (2.5) 15 (5.3) 92 (32.6) 122 (43.3) 46 (16.3)</td>
</tr>
</tbody>
</table>

CPITN: Community periodontal index of treatment needs, Figures in parentheses are in percentage.

Table 5: Logistic regression analysis of the likelihood occurrence of various systemic and oral lesions with periodontitis in the CD4 ascertained group (n=72)

<table>
<thead>
<tr>
<th>Dependant variables</th>
<th>B</th>
<th>SE</th>
<th>P</th>
<th>Significance</th>
<th>Odds ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodontitis vs Gingivitis</td>
<td>-0.0001</td>
<td>0.0021</td>
<td>0.9449</td>
<td>NS</td>
<td>0.9999</td>
</tr>
<tr>
<td>Periodontitis vs Pigmentation</td>
<td>-0.0013</td>
<td>0.0013</td>
<td>0.3129</td>
<td>NS</td>
<td>0.9987</td>
</tr>
<tr>
<td>Periodontitis vs Oral candidiasis</td>
<td>-0.0029</td>
<td>0.0016</td>
<td>0.0530</td>
<td>S</td>
<td>0.9981</td>
</tr>
<tr>
<td>Periodontitis vs Oral hairy leukoplakia</td>
<td>-0.0039</td>
<td>0.0041</td>
<td>0.3348</td>
<td>NS</td>
<td>0.9961</td>
</tr>
<tr>
<td>Periodontitis vs Pumonary tuberculosis</td>
<td>-0.0040</td>
<td>0.0018</td>
<td>0.0269</td>
<td>S</td>
<td>0.9960</td>
</tr>
<tr>
<td>Periodontitis vs Dermatological lesions</td>
<td>-0.0006</td>
<td>0.0018</td>
<td>0.7590</td>
<td>NS</td>
<td>0.9994</td>
</tr>
<tr>
<td>Periodontitis vs AIDS-related complex</td>
<td>0.0015</td>
<td>0.0013</td>
<td>0.2236</td>
<td>NS</td>
<td>1.0015</td>
</tr>
<tr>
<td>Periodontitis vs asymptomatic</td>
<td>-0.0009</td>
<td>0.0016</td>
<td>0.5912</td>
<td>NS</td>
<td>0.9991</td>
</tr>
</tbody>
</table>

P at 0.05 level considered significant, B: Parameter estimates, SE: Standard error, NS: Not significant, S: Significant, AIDS: Acquired immunodeficiency syndrome.
one third were asymptomatic at the time of presentation and in the remaining two thirds, ARC, oral candidiasis, pulmonary tuberculosis, skin lesions and genital/oral ulcers were the most common presentations.

The high prevalence of oral lesions in studies conducted in dental institutions has been attributed by Eyeson et al. to the fact that these patients are dentally aware or have presented because of oral problems. Oral lesions were a presenting symptom in 32% of the present cohort who had not presented primarily to a dental institution.

Conventional gingivitis was present in almost all subjects in both patient and control groups, an unsurprising finding in this socio-economic group. It is of interest that LGE was not seen, unlike in our earlier report where a prevalence of 47% in the HIV positive cohort was described. This might be explained by the regular prophylactic use of clotrimazole, which is routinely given by our physicians to early-diagnosed HIV patients before referral for oral care. It is also likely that greater experience and tighter diagnostic criteria have led to a reduction in such diagnoses. Indeed Robinson et al. argue that this condition was much misdiagnosed in the past. Since the threshold chosen for periodontitis absent/present diagnosis was very low, it is not surprising that was almost universally present in both groups. Importantly, however, CPITN revealed a statistically greater severity and extent of conventional periodontal breakdown in the patient cohort than in the matched controls.

This increase in periodontal tissue damage with immunosuppression due to HIV has been reported by other investigators in an Australian and in a Scottish population, respectively, though it has not been widely documented in other populations and never reported before from a developing country. The work of Barr et al. in New York City remains, a decade later, still the only well-conducted longitudinal study that revealed a faster rate of periodontal disease progression: indeed, in a recently conducted longitudinal study in London it was found that there was no convincing evidence for accelerated breakdown. However the present findings from South India are important: at least 95% of these patients had not received anti-retroviral therapy and we are likely to see a more typical natural history. Longitudinal follow-up of these patients will be informative.

CD4 status was available for 72 patients. The prevalence of both periodontitis and gingivitis was significantly greater in the CD4<200 group (92% and 96%, respectively) than in the CD4>200 group (81% and 85%, respectively). Comparison of the CPITN scores in these patients revealed that the patients with CD4<200 had more sextants (42%) with a CPITN score of 4 than the patients in the CD4>200 group. This is similar to other reports of increase in probing depths with increasing immunosuppression in HIV disease. Analysis of the CD4 counts, and the oral and systemic lesions showed that periodontitis and oral candidiasis were significantly associated with lower CD4 counts. Occurrence of periodontitis with other oral and systemic lesions was analyzed and the odds ratio computed. This revealed that the occurrence of pulmonary tuberculosis and oral candidiasis simultaneously with periodontitis was statistically significant. Oral candidiasis as a marker of immunosuppression has been confirmed by many investigators. The presence of candidal colonization in the subgingival plaque of HIV seropositive patients has been documented by many investigators. It has been suggested that oral candidal infection plays an important role in the clinical manifestation of periodontitis associated with immunosuppression and that oral candidiasis may be a better predictor of periodontitis than CD4 cell counts. In our present study both CD4 cell count and oral candidiasis were strongly related with periodontitis.

The present study suggests that CPITN is a simple, useful technique to assess the periodontal status in immunosuppressed patients. Also, periodontitis is strongly associated with CD4 cell immunosuppression and oral candidiasis.

The assessment of the periodontal status could, thus, be a useful tool in minimally invasive screening of populations for HIV disease, especially in those parts of the world like India and Africa with high prevalence and rising incidence.

REFERENCES


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