Predicting HIV in a Public Dental Facility Using Group I Oral Lesions

Abstract

Group I oral lesions have been strongly associated with HIV and in resource-poor settings could be useful predictors of HIV. No study has evaluated the predictability of these lesions in diagnosing HIV/AIDS in patients who attend dental public facilities in South Africa.

Objectives: To determine the HIV status, prevalence of Group I oral lesions and their predictive value amongst patients attending a dental clinic in Soweto, South Africa.

Methods: This cross sectional analytical study comprised of adult patients attending a dental facility over one week in 2006. All patients underwent a clinical examination by calibrated dentists.

Results: A total of 165 patients (100% response) were screened of which 87 (53%) were female. The HIV prevalence was 28% (n=46) and of those who tested positive, 15% (7) manifested with Necrotizing Ulcerative Gingivitis (NUG). This proved to be highly predictive for HIV (positive predictive value=93.8%, specificity=99.6% and likelihood ratio=40).

Conclusion: The high prevalence rate of HIV in dental facilities confirms the heavy burden of the HIV epidemic. NUG proved to be a good predictor of HIV in this setting.
Introduction

South Africa has an estimated HIV prevalence rate of 28% and the greatest number of people living with HIV/AIDS in the world (5.3 million)\(^1\). The uptake for routine testing remains low\(^2\), making it difficult for personnel at health facilities to identify and refer HIV positive patients to wellness programmes.

The Department of Health (DOH), with its limited human and technical resources, faces a major problem in diagnosing HIV positive patients. The oral cavity provides an accessible means of predicting the HIV status of suspected individuals. Pindborg\(^3\) was one of the early researchers who observed the close association between HIV/AIDS and oral lesions. Although oral lesions have been used in numerous studies to predict the HIV status\(^4,5\) no study has evaluated the predictability of these lesions in diagnosing HIV/AIDS in patients who attend dental public facilities in South Africa.
The most common forms of oral lesions associated with HIV are called the Group I oral lesions and are defined as "lesions strongly associated with HIV". These lesions are: Candidiasis, Oral Hairy Leukoplakia (OHL), Hodgkin's Lymphoma, Kaposi's sarcoma, Necrotising Ulcerative Gingivitis (NUG) and Periodontitis (NUP).

Studies have shown the prevalence of Group I oral lesions in HIV positive patients to range from 21% to 99% with the majority of these studies reporting oral candidiasis as the most common lesion present.

Oral lesions have also been used to predict the HIV status and the progression of the disease. A study by Badri et al. concluded that Oral Hairy Leukoplakia (OHL) and Oral Candidiasis (OC) could be used as a cost effective tool for screening possible HIV patients in resource-limited settings. These conclusions have been confirmed by international studies all of which have stressed the importance of a thorough oral examination for early recognition, detection and comprehensive evaluation of HIV/AIDS patients.

Some studies sought to predict the range of the CD4 count using oral lesions while others correlated the presence of oral lesions to the CD4 cell counts.

One of the limitations of all the current published studies is that the HIV status of the patients was known to the investigators before the diagnosis of Group I oral lesions were performed. Another weakness is that these studies were carried out in specialised dental clinics and hospitals which cater for HIV positive patients who are aware of their status and possibly have lower CD4 cell counts. Given these factors, these patients would present with more oral lesions than general patients who present at a primary health care dental facility for routine dental treatment. Hence these results are not truly representative of dental patients who visit oral health facilities routinely and thus possibly reflect an over-estimation of the presence of oral lesions.

The current study is unique in that:

1. the investigators were blinded to the HIV status;
2. the sample was more representative of the wider population than other studies since it was obtained from the general dental population who attended a public dental facility for acute dental treatment (extractions and the relief of pain and sepsis). It must be noted that in South Africa most adults (25%) utilise the public health sector with the remaining population utilising traditional healers (18%), private practitioners (18%) and pharmacists (12%).

Another feature of this study is the utilisation of a saliva kit rather than blood testing for the confirmation of HIV infection. The OraQuick rapid HIV Antibody saliva Test kit was used and this kit has shown to be extremely specific (99% to 99.87%) and sensitive.
The accuracy of any test in detecting true positives and true negatives is calculated by its specificity and sensitivity respectively. The closer the specificity and sensitivity is to 100%, the greater the accuracy of that test.

The aim of this study was to determine the predictive value of Group I oral lesions for HIV infection in the general adult population attending a dental facility in Soweto.

The objectives were to determine:

1. the demographics of HIV patients;
2. the burden that HIV places on the dental public health facilities in Gauteng and
3. the predictive value of Group I oral lesions for HIV infection.

Methods

This was a cross-sectional analytical study. The target population consisted of a convenience sample of all adult patients who presented for acute dental treatment at the Lillian Ngoyi facility in Soweto, Johannesburg. This facility treats approximately 800 patients per month and provides basic dental services including relief of dental pain and sepsis, dental extractions, dental restorations and scaling and polishing. In addition the facility also provides denture services to pensioners and removable orthodontic appliances for school children.

The study was limited to a randomly chosen one week period (27 June to 9 July 2006). All patients older than 18 years who attended for acute dental care (extractions and the relief of pain and sepsis) were included in the study. These patients were considered as "walk in" patients who are regarded as placing a "burden" on facilities. The "booked" patients (those attending for restorations, scaling and polishing and dentures) were excluded as they were not categorized as patients placing a burden on the facility due to HIV. Attendees who were younger than 18 years were excluded due to consent not always being provided.

Since the HIV status was not known by the clinicians, no attempt was made to enquire whether patients were on anti-retroviral treatment. This must be considered as a potential confounder as it may have reduced the prevalence of Group I oral lesions amongst the HIV positive cohort.

A minimum sample size of 114 was required in order to make generalizations from this sample using the Epi Info software package. The confidence interval was set at 80%, the population size was estimated to be 800 (the average number of patients who attend this dental facility for acute care), the expected frequency and range of HIV being 28% and ± 5% respectively.
Permission to carry out an oral examination and to determine the HIV status was obtained from the Department of Health and University of the Witwatersrand ethical committees.

Prior to patient recruitment, all patients were informed by trained counselors about the aims and objectives of this study. Individual counseling was provided to all patients who agreed to participate and signed informed consent was obtained. Two clinicians who were calibrated for the diagnosis of oral lesions performed the oral examinations. These clinicians attended an international calibration workshop entitled "Calibration of Oral Lesions in HIV Disease" facilitated by Prof S.J. Challacombe who is the current chairperson of the International Steering Committee on Oral Health and Disease in AIDS. The workshop was hosted at the University of the Witwatersrand, Johannesburg.

The diagnosis of oral lesions was based on the European Clearinghouse Criteria (ECC)\(^7\) and confirmed by consensus. The results were then entered onto a data collection sheet. Unlinked and anonymous HIV testing was carried out by a third examiner who was also blinded to the diagnosis of oral lesions made by his colleagues.

The HIV status of the patient was determined using the OraQuick® Rapid HIV ½ Antibody Saliva Test Kit. Saliva was taken using a dipstick containing a paper absorbent spatula and then placed into an enzyme bottle. The HIV result was read after 20 minutes and entered onto a HIV status form. In this way the data collection form and HIV status form were separated and the results were only combined at the end of each day.

Patients who wanted to know their HIV status were referred back to the counselors and were then directed onto the Voluntary Counseling and Testing (VCT) programme present at the facility.

The patients oral and HIV status was combined by means of linking the bar-codes on the two data capture sheets (one for the oral examination and one for the HIV status).

Four epidemiological tests were used to correlate the Group I oral lesions to the HIV status and these were:

- sensitivity (Sen),
- specificity (Spec),
- positive predictive value (PPV),
- likelihood ratio (LR).

\(^7\) European Clearinghouse Criteria
Results

All 165 adult patients who had attended the facility for acute treatment during the study period agreed to participate (100% response rate).

The age ranged from 18 to 81 years with an average of 33.5 years (SD 14.73). More than half (53%; N=87) of the respondents were female. The overall HIV prevalence was 28% (n=46) and almost two thirds of them (n=30/46, 65%) were female (Figure 1).

The age distribution for those who tested HIV positive is shown in Figure 2. The majority of the HIV positive patients were in the 26- to 35-year age group.

Amongst the patients who were diagnosed HIV positive, only eight (5%) presented with Group I oral lesions and all of them had Necrotizing Ulcerative Gingivitis (NUG). No other Group I oral lesions were diagnosed. Therefore all of the statistical tests were carried out using NUG (Table 1).
Since the odds ratio cannot be calculated if there is a zero in any one of the cells in the two by two tables, 0.5 was added to all cells as recommended by Strietzel et al\textsuperscript{20}. The sensitivity was low (16\%) while the specificity and PPV were high (99.6\% and 93.8\% respectively). The Likelihood ratio (LR) was very high (40).

Of those who tested HIV negative, only one patient presented with an oral lesion which was diagnosed as Pseudomembranous Candidiasis (PC).

### Table 1: Predictive values of NUG in diagnosing HIV

<table>
<thead>
<tr>
<th></th>
<th>Formulae</th>
<th>Results (CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity (Sen)</td>
<td>$A/A+C=7.5/47 \times 100$</td>
<td>16% (0.08-0.29)</td>
</tr>
<tr>
<td>Specificity (Spec)</td>
<td>$D/B+D=119.5/120 \times 100$</td>
<td>99.6% (0.96-0.99)</td>
</tr>
<tr>
<td>Positive Predictive Value (PPV)</td>
<td>$A/A+B=7.5/8 \times 100$</td>
<td>93.8% (0.53-0.99)</td>
</tr>
<tr>
<td>Likelihood Ratio (LR)</td>
<td>$\text{Sen}/1-\text{Spec}=0.16/0.004$</td>
<td>40 (2.23-657.31)</td>
</tr>
</tbody>
</table>

### Discussion

The high response rate (100\%) was almost entirely due to the excellent rapport that the counselors and staff had with the patients and the fact that no blood samples were required for the HIV test. The patients appreciated the ease with which the HIV test was carried out. In the week during which the study was being carried out, the uptake for Voluntary Counseling and Testing (VCT) more than doubled and this demonstrated the importance of creating awareness among patients in dental clinics for a procedure that has a low uptake in South Africa.

Both the overall HIV prevalence of 28\% and the prevalence of HIV amongst females (34\%) and males (21\%) were similar to the National South African figures\textsuperscript{1}.

The HIV prevalence rates among the 31-35 years (53\%) and 26-30 years (48\%) were the highest in the different age groups. These rates should be of concern to health care workers as almost half of all patients between the ages of 26 and 35 years could be HIV positive. This confirms the importance of standard infection control procedures and an effective prophylactic exposure procedure in dental clinics in the event of a needle stick.
and/or other occupational injuries.

The prevalence of oral lesions among the HIV positive patients was low (15%) compared to other studies\textsuperscript{6}. NUG was the only oral lesion diagnosed. The lack of the more common oral manifestations such as oral candidiasis, angular cheilitis and oral hairy leukoplakia suggests that, in the general adult dental population, these lesions are not as prevalent as other published studies\textsuperscript{6,21}. Possible reasons for this difference could be attributed to:

- Our population was more representative of the general dental population that attends for dental treatment.
- Other study populations consisted of hospital based patients (generally with low CD4 cell counts) or patients in specialized HIV infection clinics where the HIV status is known and therefore the prevalence of oral lesions could be over estimated.

The majority of the study population in this investigation attended this facility for relief of dental pain and sepsis but appeared healthy and did not present with the pathogenomic signs or symptoms associated with HIV such as malaise, cachexia, underweight and the presence of opportunistic infections. It is possible that some of the patients were still in the early stages of infection and thus relatively healthy. The early identification may have been possible with a CD4 cell count but the resources for this are only available at specialized HIV clinics. Therefore, given the high HIV prevalence rate (28\%) and the lack of visible signs of HIV, health workers must remain vigilant at all times and practice standardized infection protocols.

Of note was the lack of oral candidiasis (OC) in the HIV positive cohort. Various studies have reported OC as the most prevalent oral lesion amongst HIV positive patients. A possible reason for the lack of OC in this study could be attributed to the overall well-being of the patients in this study and their likely higher CD4 cell counts. It must be noted however, that no blood samples were taken to measure the patients' CD4 cell counts.

The low sensitivity, high specificity and high predictive values of NUG were similar to results from Patton\textsuperscript{4} who reported that Group I oral lesions were highly predictive of HIV/AIDS. No study has used the likelihood ratio to correlate oral lesions and the HIV status of patients. However, this study showed an extremely high likelihood ratio of 40 (anything greater than 10 is considered to be a strong correlation)\textsuperscript{22} which meant that patients with NUG were 40 times more likely to test HIV positive compared to patients without NUG.

The predictive value (100\%) of NUG in HIV positive patients in this study was higher than the 70\% reported by Shangase et al\textsuperscript{23} and could be due to differences in the sample population. The Shangase study comprised patients who were specifically referred to a
periodontal clinic within a tertiary dental hospital and who were unaware of their HIV status. Not all of those who were diagnosed with NUG/NUP (in the above study) consented to have their blood taken for an HIV test and hence these patients were not included in the final analysis of results. This reduced the prevalence of NUG/NUP among the study population and could have contributed to the lower predictive value as confirmed by the authors.

It must be noted that studies done in the 1990s reported low levels of knowledge amongst oral health staff regarding the diagnosis of oral lesions associated with HIV. However, even more recent studies show that there is nevertheless a need to reinforce and enhance the diagnostic skills of oral health workers regarding Group I oral lesions. Workshops and calibration exercises could be offered so that oral health workers become more confident and accurately diagnose oral lesions associated with HIV/AIDS.

A key message of this study is to alert dentists to the fact that although the prevalence of Group I oral lesions was low in the cohort of patients whose profile was similar to patients in the general population, a high prevalence (28%) similar to the national figures suggests that ongoing awareness is required in terms of infection control procedures. Almost 1 in 3 of these "apparently healthy" patients was HIV positive.

Conclusion

The high prevalence rate of HIV (28%) provides strong evidence of the heavy burden of this disease in Soweto dental facilities. The majority of HIV positive patients were females and the highest HIV prevalence occurred in the 26- to 35-year age group. Although the prevalence of Group I oral lesions was low (5%), oral health workers need to be extremely vigilant and acutely aware that many patients who present with no general visible signs and symptoms of HIV/AIDS could be infected. This could pose a serious risk to both themselves and other patients. Necrotizing ulcerative gingivitis proved to be highly predictive of HIV in this dental setting. The high specificity and predictive values of NUG within this cohort make it a useful indictor of HIV and should arouse suspicion in clinicians when treating patients.

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Sorry, Comments are not available for this article.