Solanum supinum - ‘Intuma’ (Zulu) ‘Tandpyn bos’ (toothache bush)
Well known in the Western and North-Western parts of the Cape as a toothache remedy. Either using pounded roots or the pulp of fruit applied directly to the offending tooth... or smoke from burning leaves or fruits directed into the mouth. Contains steroidal alkaloids which have a sedative effect.

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September...Oral Health Month

September is here; with it comes Spring Day, beautiful flowers, sunshine and…… Oral Health Month. Most people enjoy this time of the year since we are surrounded by beautiful colours, blooming flowers, life simply seems better. It is also that time when The South African Dental Association (SADA) rockets into raising public awareness, and promoting good oral health, in an effort to prevent oral disease and improve the quality of life of our communities.

Oral diseases such as dental caries, periodontal disease, oral cancer, oral infectious diseases, together with trauma from injuries, and hereditary conditions remain major public health concerns globally. Dental caries, which is largely preventable, remains the most common disease on the planet, affecting 60-90% of school children and the vast majority of adults. It is about five times as common as asthma and seven times as common as hay fever. Dental caries is responsible for a lot of PAIN, discomfort, dysfunction, poor appearance, loss of self esteem, days missed at school and work resulting in reduced productivity and difficulty in concentrating on daily activities.

Recent research has also established possible links between chronic oral infections and diabetes, heart and lung disease, stroke, and low birthweight or premature births, reaffirming that oral health is part of general health. Or as eloquently put by Dr Pamela McClain, President of the American Academy of Periodontology, “Your body can affect your mouth and likewise, your mouth can affect your body. Taking good care of your teeth and gums can really help you live well longer.” Dr McClain is not the only one posting this. The past 10 to 15 years have seen ballooning interest in possible links between oral health and general health.

The World Health Organisation has also stated as an objective that the world population should have good oral health. This would translate to patients being free of chronic mouth and facial pain, oral and throat cancer, oral sores, periodontal disease, tooth decay and tooth loss, and other preventable diseases and disorders affecting the mouth and oral cavity.

SADA shares the WHO sentiments, and encourages its members working in both the public and private sector to engage with their communities to educate them, whether in Oral Health Month or at any other time, on the importance of good oral health, diet and the recent developments in research. It is a well known fact that prevention is a fundamental aspect in attempting to improve the oral health status of our communities.

Demonstrating its commitment to promoting oral health as an integral part of general health, SADA in conjunction with the Dental Schools, has been managing educational theme campaigns focused on educating both the dentist and the public on systemic conditions that have a direct impact on oral health or vice versa. The themes that have been covered thus far are:

- Oral Cancer (2012)
- Periodontal disease and related systemic diseases (2013)
- Substance and Physical Abuse: The effects on Oral Health (2014)

SADA is also a signatory of the Alliance for a Cavity-Free Future (ACFF). The ACFF, a non-profit charitable organization, is a worldwide group of experts who have joined together to promote integrated action in clinical and public health in order to stop caries initiation and progression in order to move towards a Cavity-Free Future for all age groups.

September also came with changes in the oral health landscape; this is indeed a new era in Dentistry as SADA as a stakeholder in the oral health care industry was requested to make comments on the draft South African National Oral Health Strategy 2015 (NOHS) which was compiled by the National Department of Health. The NOHS in its preamble states that ‘Oral health is central to our daily life and well-being, and exerts a fundamental influence on the quality of life of every citizen of South Africa’. It further states that ‘It is quite clear from both community experience and research evidence in the literature, that oral health is more than just the absence of disease or loss of function. Citizens are increasingly aware that the optimal functioning of their face and mouth is important for their own comfort and for preserving their self-esteem. Individuals and communities have to be made aware of the risks involved that cause oral diseases and how they can be involved in preventing or eliminating these risks. They can be informed through outreach, health education and health promotion’.

The strategies presented in the NOHS include the following:

- The provision of Basic Oral Emergency Care for all citizens
- Prevention of oral diseases and promotion of oral health
- The provision of basic primary oral health care treatment
- The provision of secondary and tertiary level care for all citizens: This will include the provision of other
services including fillings, dentures, treatment of oro-facial trauma, oral cancer, treatment under general anaesthesia, etc.  
• Reduction of the burden of untreated oral diseases  
• The Common Risk Factor Approach  
• The development of population-oriented interventions  
• The integration of oral health across health disciplines and sectors  
• The implementation of evidence-based intervention  
• The adoption of customized local and/or district oral health operational plans  
• The utilization of Oral Health Training Institutions (OHTIs) in provision of services and training of oral health professionals

SADA welcomed the opportunity to make comments on the document, and their submission was based on the International Guidelines for the Assessment of Oral Health Strategies which have been well documented. Based on the definition for health promotion as set out by the Ottawa Charter of 1986, the WHO in 1998 developed a list of criteria that can be used to assess oral health strategies (subsequently adapted and modified by Watt in 2005). Hereunder elements of the framework on which the SADA submission was based:

**EMPOWERING**
Individuals as well as the broader community or district should be empowered by the given strategy to take control over factors (socioeconomic and environmental) that affect their oral health.

**PARTICIPATORY**
Key stakeholders (public sector, private sector, community leaders) should be motivated to all take an interest and participate in the planning, implementation and evaluation of oral health strategies.

**HOLISTIC**
Oral health strategies should focus on common risk factors and thus aim to improve not just the oral health of a specific community or district but also the physical, social and mental wellbeing.

**INTERSECTORAL**
Relevant sectors should be involved to help elevate the importance of oral health strategies on the agenda of a wider range of sectors.

**EQUITY**
Oral health strategies should aim to eliminate all forms of inequality in the delivery of oral health across different communities.

**EVIDENCE BASED**
The relevant strategy should be based on current best scientific knowledge as well as good clinical practice.

**SUSTAINABLE**
Strategies should enable changes that are easy to maintain by individuals, relevant communities and districts once the start-up funding of the strategy has run out. Communities should thus be able to maintain the strategy.

**MULTI-STRATEGY**
Oral health strategies should be based on a variety of methods and approaches varying from education and policy change to legislation and community development.

**EVALUATION**
The strategy should be able to be appropriately evaluated using both process and outcome based measures. SADA’s submission went further to dissect, critique and congratulate the Department on its efforts.

Maretha Smit, the CEO of the South African Dental Association concluded by stating that: “A great and enduring strength of the South African democracy lies in its commitment to the care and well-being of its citizens.”

“As an Association in the oral health environment, we believe that:

• no one should suffer from oral diseases or conditions that can be effectively prevented and treated  
• no schoolchild should suffer the stigma of craniofacial birth defects nor be found unable to concentrate because of the pain of untreated oral infections, and  
• no rural inhabitant, or homebound adult, or inner city dweller should experience poor oral health because of barriers of access to care and shortages of resources and personnel.

“Taking into account the costs of dental care, the impact of oral health on general health and its impact of quality of life, it is clear that a paradigm shift is required in order to deliver oral health to the broader population. It is abundantly clear that the enormous task facing the National Department cannot be accomplished by any single agency, be it at the national, provincial or district levels or in private organisations. Rather, actions will have to be developed through a process of collaboration and communication across public and private domains. Successful execution will call for partnerships that unite private and public groups focused on common goals. We thank you for this opportunity and trust that you will undertake to consult with us in further deliberations before the NOHS is finalised.”

The long awaited White Paper on the National Health Insurance (NHI) is also completed. However, it is still not ready for public consumption since Minister Aaron Motsoaledi has yet to present it to Cabinet. The Minister revealed this at the South African Medical Association’s conference at the Sandton Convention Centre. The Minister also stated that “the document was with Treasury (for a financing model) and at the next cabinet space he has, he would present it”. Further that “Technology, different business models and a change in behaviour in public health facilities will all be central to changing public healthcare in South Africa.”

Finally, we are excited that South Africa will for the very first time have the privilege of hosting the IFED congress (5-7 November 2015) in the Mother City. The congress will showcase 20 leading international speakers over three days; this is an African first and an event not to be missed.

September 2015, National Oral Health Month has indeed been a significant time in the Oral Health Environment. Not only did we celebrate OHM but we also received opportunities to influence and make comments on policy documents that will guide how Oral Health is delivered in our beautiful country.
SUMMARY

Introduction: The administration of HAART* has changed the frequency and character of the oral complications of HIV disease.

Aims and objectives: This study describes and compares the incidence and status of dental caries and the number and type of oral mucosal lesions in hospital outpatients with these data in institutionalized children who had accepted a dedicated oral and dental management programme for HIV-infected patients.

Design: This was a retrospective, descriptive cross-sectional study in which existing medical records were reviewed and a clinical examination performed.

Methods: The oral cavity of each patient was examined by two calibrated clinicians who used mouth mirrors under artificial light. The presence and status of dental caries and the presence of oral soft tissue lesions were recorded using, respectively, the WHO Oral Health Surveys Basic Methods and the diagnostic classification and criteria for oral soft tissue lesions associated with HIV of the EC-Clearinghouse.

Results: Oral lesions and dental caries were significantly higher (p<0.001) in hospital outpatients than in institutionalized children. Caries prevalence (p = 0.002) and severity (p<0.0001) were significantly higher in hospital outpatient children receiving HAART than in those not on HAART.

Conclusions: The prevalence of oral lesions was significantly reduced (p = 0.025) in children receiving HAART. Caries prevalence was significantly higher in children receiving HAART than in those not on HAART.

*HAART involves the simultaneous administration of three main classes of drugs together with a fourth subclass. Examples are:
- Nucleoside analogue reverse transcriptase inhibitors (nRTI’s)
- Protease inhibitors (PI’s)
- Non-nucleoside reverse transcriptase inhibitors (NNRTI’s)
- Nucleotide transcriptase inhibitors (NTI’s) Subclass.

INTRODUCTION AND BACKGROUND

Whilst there are very few published studies of oral manifestations of HIV in children in Africa, Naidoo and Chikte did investigate the status in children not receiving HAART in South Africa.1-3 The frequency and character of the oral complications of HIV disease has changed with the introduction of HAART.1-3 Research on the extent of these changes in children is important in the context of developing countries where efforts are being made to scale up the provision of HAART to eligible patients.5

This study describes and compares the frequency and status of dental caries and the number and type of oral

ACRONYMS

DMFT: decayed, missing, filled teeth (lower case dmft for deciduous dentition)
EC: European Common Market
HAART: Highly Active Anti-Retroviral Therapy
HIV: Human Immunodeficiency Virus
LGE: Linear Gingival Erythema
NUG: Necrotizing Ulcerative Gingivitis
WHO: World Health Organisation

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mucosal lesions in HIV-infected children who accepted a dedicated oral and dental programme. The occurrence of oral lesions was related to levels of CD4 cell counts.

OBJECTIVES OF THE STUDY

1. To describe the demographic characteristics of HIV positive children attending a hospital outpatient department and of those in an institutionalized setting.
2. To describe and compare (a) the dental caries status and (b) the number and type of oral mucosal lesions in HIV positive children between those attending a hospital outpatient department with those of children residing in an institutionalized setting.
3. To assess the association between the presence of oral mucosal lesions and the levels of CD4 cell counts among children in the hospital outpatient department.
4. To compare the prevalence of oral mucosal lesions among the hospital outpatient department children between those on HAART and those not receiving HAART.

MATERIALS AND METHODS

Study design
This was a descriptive cross-sectional study with data gathered from medical records, a questionnaire and clinical examinations.

Study population
The study population consisted of HIV infected paediatric patients referred to George Mukhari and Kalafong outpatient HIV clinics between May 2005 and April 2006 and of HIV infected children institutionalized in twenty orphanages in Johannesburg, Pretoria and Bronkhorstspruit. During the observation period 486 children visited the outpatient clinics and 291 were examined at the orphanages.

Ethical considerations
Parents/caregivers gave permission for children to participate in this routine health service at the outpatient HIV clinics of Kalafong and George Mukhari Hospitals and at orphanages caring for children diagnosed as having HIV in Johannesburg, Pretoria and Bronkhorstspruit. The study protocol was approved by the Ethics Committee of the University of Limpopo (Medunsa Campus).

Study sample
The sample size was calculated based on two sets of prevalence data:

I. The prevalence of oral lesions in hospital outpatient children in Cape Town, South Africa was found by Naidoo and Chikte to be 63%.1

II. The prevalence of oral lesions in institutionalized children in Cape Town, South Africa was found by Naidoo and Chikte to be 45%.1

The sample size for hospital outpatient children was estimated at 206 in Epi Info Version 3.3.2 software, at the confidence interval of 95% and absolute precision of 5% assuming 63% oral lesions prevalence. In the event, a sample of 222 was drawn. The sample size for institutionalized children was estimated at 165 in Epi Info Version 3.3.2 software at the confidence interval of 95% and absolute precision of 5% assuming 45% oral lesions prevalence. However, a sample of only 152 was drawn.

Sampling method
Random samples were selected. The lottery method of random sampling was used, i.e. patient files were assigned numbers, and coupons with serial numbers ranging from 1 to 486 were then thoroughly mixed in a bowl and a sufficient number were drawn at random (without replacement) to provide the desired sample size. Files corresponding to drawn numbers were separated for analysis and the remainder (non-selected files) were returned to the archives.

The research was conducted at outpatient HIV clinics of academic hospitals (Kalafong and George Mukhari) in townships on the outskirts of Pretoria, and at orphanages caring for children diagnosed with HIV in Johannesburg, Pretoria and Bronkhorstspruit.

Parents/guardians were interviewed using a structured questionnaire to obtain information regarding medical history, current medications and demographic details. Data relating to CD4 cell counts were extracted from the patients’ clinic medical records. The oral cavity of each sitting patient was examined under artificial light by two calibrated clinicians using mouth mirrors. The status and frequency of dental caries and the presence of oral soft tissue lesions were assessed. The Oral Health Surveys Basic Methods of WHO were used to record dental status.6 The diagnostic classification and criteria for oral soft tissue lesions associated with HIV of the EC-Clearinghouse were applied.7 The collected data were captured in custom-made Monitoring and Evaluation data capture sheets. After completion these documents were filed in the office of the Programme Director.

MEASUREMENTS

Medical records
The data from the medical records, the completed questionnaires and from the clinical examinations were assembled in custom-designed computer monitoring and evaluation records and were coded and cleaned in Microsoft Excel software before statistical analysis.

Variables
The recording of current medication was limited to categories which were used to treat HIV and associated opportunistic infections (antiretrovirals, antifungals and antibiotics).

Dental caries were recorded using the Oral Health Surveys Basic Methods of WHO.7

Oral soft tissue lesions were evaluated using the diagnostic classification and criteria for oral soft tissue lesions associated with HIV of the EC-Clearinghouse.8

CD4 cell counts were sourced from laboratory reports.

STATISTICAL ANALYSIS / HYPOTHESIS TESTING

Frequencies, means and proportions were calculated and the data were subjected to univariate, bivariate and multivariate analysis in Statistical Analysis Software (SAS) software. Fisher’s exact test was performed to test the statistical significance of differences observed in the incidence of caries, and in the presentations of oral lesions between children examined at outpatient clinics...
and orphanages. The chosen significance level of the tests was a p-value of less than 0.05. Statistical tests were performed: the Mann-Whitney U test to compare DMFT or dmft components between the groups; Student’s t-test to compare CD4 means between children on HAART and those not on HAART; a Chi-squared test to identify any statistical significances in the differences observed in the prevalence of oral lesions in children with a CD4 count <200 cell/mm³ and those with a CD4 count >200.

### RESULTS

The data of randomly selected samples of 222 hospital outpatient clinic and 152 institutionalized children were analyzed.

#### Objective 1: Demographic characteristics

The average age of hospital outpatient children was four years (range: one to 14 years). Half the children were aged between two and seven years.

The average age of institutionalized children was six years with a range between one and 22 years. Half of the children were aged between four and nine years.

Just less than forty percent (39.1%) of hospital outpatient children were taking antiretrovirals, either alone or in combination with other medication. Antimicrobial polypharmacy was high at 38.8% with a total of 76.1% of children taking antibiotics. Antifungal use was limited to 11.1%. A tenth (24) of the patients were not on antimicrobials.

Sixty percent of institutionalized children were taking antiretrovirals. Half of the children were on antimicrobial polypharmacy. Two-thirds were taking antibiotics. Just under a quarter (22.4%) were not on antimicrobials (Table 1).

#### Objective 2a: Description and comparison of dental caries status

Dental caries was recorded in a considerably greater proportion of the hospital outpatient children compared with the incidence amongst institutionalized children (50% vs. 30%). Just over two-thirds of the latter group (106) were caries free (Table 2). One and a half times as many hospital outpatient children on HAART as compared with those not on HAART (63.2% vs.41.5%) presented with caries, a statistically significant difference (Table 3).

<table>
<thead>
<tr>
<th>Table 1: Current medication</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Antimicrobial types and combinations</strong></td>
</tr>
<tr>
<td><strong>Antiretroviral</strong></td>
</tr>
<tr>
<td><strong>Antifungal</strong></td>
</tr>
<tr>
<td><strong>Antibiotics</strong></td>
</tr>
<tr>
<td><strong>Antiretroviral + Antifungal + Antibiotics</strong></td>
</tr>
<tr>
<td><strong>Antibiotics + Antiretroviral</strong></td>
</tr>
<tr>
<td><strong>Antifungal + Antiretroviral</strong></td>
</tr>
<tr>
<td><strong>Antibiotics + Antifungal</strong></td>
</tr>
<tr>
<td><strong>Not on antimicrobials</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2: Comparison of caries prevalence among hospital outpatient (n=222) and institutionalized children (n=152)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dental caries, n (%)</strong></td>
</tr>
<tr>
<td><strong>Present</strong></td>
</tr>
<tr>
<td><strong>Hospital</strong></td>
</tr>
<tr>
<td><strong>Institution</strong></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3: Comparison of caries prevalence among hospital outpatient children on HAART and those not on HAART</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dental caries, n (%)</strong></td>
</tr>
<tr>
<td><strong>Present</strong></td>
</tr>
<tr>
<td><strong>HAART</strong></td>
</tr>
<tr>
<td><strong>Not on HAART</strong></td>
</tr>
</tbody>
</table>

| Hospital outpatient children | Institutionalized children |
|-----------------------------|
| **Age groups** | **children n (%)** | **caries teeth n (%)** | **children n (%)** | **caries teeth n (%)** |
| **< 5 years** | 50 (45) | 330 (50.3) | 9 (19.6) | 51 (23.2) |
| **6 years** | 18 (16.2) | 114 (17.4) | 6 (13) | 50 (22.7) |
| **7-11 years** | 39 (35.1) | 197 (30) | 26 (56.5) | 105 (47.7) |
| **12 years** | 2 (1.8) | 10 (1.5) | 0 | 0 |
| **>12 years** | 2 (1.8) | 5 (0.8) | 5 (10.9) | 14 (6.4) |
| **Total** | 111 (100) | 656 (100) | 46 (100) | 220 (100)* |

*Age data was missing from records of two Hospital outpatient children.

Hospital outpatient children six years and under accounted for two thirds of the carious teeth occurring in this group (Table 4). Thirty percent of the carious teeth were recorded in the 7-11 years age range. Half the children (111) were caries free.

Amongst the institutionalized children, those 7 years and older accounted for 54% of the carious teeth observed in the group.

The mean DMFT and D components were higher in hospital outpatient children on HAART than in those not on HAART (0.28 vs.0.21 and 0.26 vs.0.21). The differences were not, however, statistically significant. (Table 5).

<table>
<thead>
<tr>
<th>Table 4: Caries distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age groups</strong></td>
</tr>
<tr>
<td><strong>children n (%)</strong></td>
</tr>
<tr>
<td><strong>DECIQUOUS</strong></td>
</tr>
<tr>
<td><strong>On HAART</strong></td>
</tr>
<tr>
<td><strong>Not on HAART</strong></td>
</tr>
<tr>
<td><strong>Mann-Whitney U test</strong></td>
</tr>
<tr>
<td><strong>PERMANENT</strong></td>
</tr>
<tr>
<td><strong>On HAART</strong></td>
</tr>
<tr>
<td><strong>Not on HAART</strong></td>
</tr>
<tr>
<td><strong>Mann-Whitney U test</strong></td>
</tr>
</tbody>
</table>
The mean dmft and d components in hospital outpatient children on HAART were more than double (4.29 vs. 1.75 and 4.24 vs. 1.75) those in children not on HAART. There is strong evidence (p <0.0001) that there is statistical significance in this difference. (Table 5).

**Objective 2b: Description and comparison of number and type of oral mucosal lesions**

Prevalence of oral lesions: Oral lesions were recorded in just less than forty percent (n=84) of hospital outpatient children and in less than a quarter (n=34) of institutionalized children (p<0.001).

Number of oral lesions in a mouth: multiple lesions were recorded in six (7.1%) hospital outpatient children and in four institutionalized children (11.8%). (Table 6).

Pseudomembranous candidiasis was the most common lesion at 81.1% in hospital outpatient children. Herpetic ulcer was the second common lesion at 7.8%. Candidiasis in its two forms was the most common lesion at 71% in institutionalized children, followed by angular cheilitis at 13.2%. However, pseudomembranous candidiasis was recorded in almost three times as many hospital outpatient children as institutionalized children (30.18% vs.10.53%), a highly statistically significant finding (p<0.001). (Table 6).

**Objective 3: Association between the presence of oral mucosal lesions and CD4 cell count among the hospital outpatient department children**

The data presented in Table 7 confirms that there is insufficient evidence (p >0.05) to demonstrate any significant difference in mean CD4 counts between patients on HAART and those not on HAART in the population.

Oral lesions were more common (54.5%) in children with a CD4 count <200 cell/mm³ but the differences were not statistically significant (p=0.21). The association between oral lesions and CD4<200 in children not on HAART was three times higher than that in children on HAART, a statistically significant difference (81.8% vs.27.3%). (Table 8.)

The association between the incidence of oral lesions and CD4>200 was higher in children not on HAART (45.9% vs. 28.6%), the p-value being only just greater than 0.05, suggesting that the difference in the occurrence of oral lesions between the children at CD4 >200 who are on HAART and those not on HAART is approaching statistical significance.

**Objective 4: Comparison of the prevalence of oral mucosal lesions among hospital outpatient children between those on HAART and those not on HAART**

More than double the number of oral lesions were recorded in children not on HAART as in children on HAART, a statistically significant difference (70.2% vs. 29.8%).

---

**Table 6: Prevalence of oral lesions and frequency of occurrence of types**

<table>
<thead>
<tr>
<th>Lesion types</th>
<th>Hospital outpatient children</th>
<th>Institutionalized children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudomembranous candidiasis</td>
<td>73 (81.1%)</td>
<td>20 (52.6%)</td>
</tr>
<tr>
<td>Erythematous candidiasis</td>
<td>0</td>
<td>4 (18.4%)</td>
</tr>
<tr>
<td>Parotid enlargement</td>
<td>2 (2.2%)</td>
<td>1 (2.6%)</td>
</tr>
<tr>
<td>Hairy leukoplakia</td>
<td>1 (1.1%)</td>
<td>0</td>
</tr>
<tr>
<td>LGE</td>
<td>1 (1.1%)</td>
<td>3 (7.9%)</td>
</tr>
<tr>
<td>Herpetic ulcer</td>
<td>1 (1.1%)</td>
<td>1 (2.6%)</td>
</tr>
<tr>
<td>Herpetic stomatitis</td>
<td>7 (7.8%)</td>
<td>0</td>
</tr>
<tr>
<td>Angular cheilitis</td>
<td>2 (2.2%)</td>
<td>5 (13.2%)</td>
</tr>
<tr>
<td>NUG</td>
<td>1 (1.1%)</td>
<td>1 (2.6%)</td>
</tr>
<tr>
<td>Kaposi sarcoma</td>
<td>1 (1.1%)</td>
<td>0</td>
</tr>
<tr>
<td>Molluscum contagiosum</td>
<td>1 (1.1%)</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>90 (100%)</td>
<td>38 (100%)</td>
</tr>
</tbody>
</table>

---

**Table 7: CD4 cell counts of children on HAART and those not on HAART**

<table>
<thead>
<tr>
<th>CD4</th>
<th>Patients on HAART</th>
<th>Patients not on HAART</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;100</td>
<td>4 (6.67%)</td>
<td>3 (2.75%)</td>
</tr>
<tr>
<td>100-200</td>
<td>7 (11.67%)</td>
<td>8 (7.34%)</td>
</tr>
<tr>
<td>&gt;200</td>
<td>49 (81.67%)</td>
<td>98 (89.91%)</td>
</tr>
<tr>
<td>Total</td>
<td>60 (100)</td>
<td>109 (100)</td>
</tr>
</tbody>
</table>

* HAART status data missing in 53 children

---

**Table 8: Association in the occurrence of oral lesions and use of HAART after adjusting for CD4 cell count (n, %). p = 0.05**

<table>
<thead>
<tr>
<th>Lesions in cases with CD4&lt;200</th>
<th>Lesions in cases with CD4&gt;200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>On HAART</td>
<td>3 (27.3%)</td>
</tr>
<tr>
<td>Not on HAART</td>
<td>9 (81.8%)</td>
</tr>
<tr>
<td>Total</td>
<td>12 (54.5%)</td>
</tr>
</tbody>
</table>

Fisher’s Exact Test

p = 0.03

p = 0.051
The incidence of pseudomembranous candidiasis was statistically significantly different between children on HAART and those not receiving the drugs (36.30% vs. 20.69%, $p = 0.016$). (Table 10) There is insufficient evidence, however, at $p > 0.05$, to identify statistically significant differences between the prevalences of herpetic stomatitis, angular cheilitis and parotid enlargement recorded for children on HAART and those not on HAART in the sample population.

### DISCUSSION

**Objective 1: Demographic characteristics**

Antiretroviral use was higher (60%) in institutionalized children than in hospital outpatient children (39.1%). The proportion of children on HAART at George Mukhari and Kalafong outpatient HIV clinics was significantly (20%) lower than that reported by Michaels and colleagues in a similar setting. This finding may be explained by the fact that the non-governmental organization (NGO) community, which founded many of these orphanages investigated by Michaels et al. offered antiretroviral medication earlier than Government hospitals. The Government had initially doubted the effectiveness of antiretrovirals.

Antibiotic use in the two population groups was high i.e. 66.4% for institutionalized children and 76.1% for hospital outpatient children. This may have been related to prophylaxis instituted against pneumocystis carinii pneumonia, which was commenced when the CD4 dropped below 200 cells/ml or when there were clinical signs of advanced immune deficiency.

**Objective 2a: Description and comparison of dental caries status**

Caries prevalence was significantly higher ($p < 0.001$) in hospital outpatient than in institutionalized children. The bulk of this caries was untreated and affected deciduous teeth. This result has not previously been described and is in fact difficult to explain, but may be related to the high sugar content of AZT and other HIV medications and the decreased salivary flow associated with HAART use. These results need to be interpreted with caution as the precise HAART regimen and duration of use were not studied. This finding, while preliminary, does however suggest that the use of HAART is associated with an increased risk of dental caries in children. Previous research has described the prevalence of dental caries in adults receiving HAART when a lower prevalence of dental caries in HAART patients was reported. Further studies on the topic of antiretroviral medication and dental caries risks are therefore recommended.

**Objective 2b: Description and comparison of number and type of oral mucosal lesions**

The prevalence of oral lesions was significantly higher ($p < 0.001$) in hospital outpatient than in institutionalized children and was associated mainly with the occurrence of oral candidiasis. This finding is in agreement with that of Naidoo and Chikte and of a great deal of the previous work in this field which documented candidiasis as the most frequently occurring manifestation in HIV-infected children. A possible explanation for this might be a relatively high level of malnutrition and poor oral hygiene in hospital outpatient children, factors which have been reported to predispose to the expression of oral lesions. No more than two lesions per child were observed in the study groups. This finding does not support the previous research which reported up to five oral lesions per child. This inconsistency may be due to the use of HAART in this study.

More types of oral lesions (10 vs. 7) were observed in hospital outpatient than in institutionalized children. A variable clinical spectrum of HIV associated oral lesions in children has been described in diverse settings in South Africa, but the types of oral lesions observed in this study were largely consistent with those reported by Naidoo and Chikte with NUG, LGE, herpetic stomatitis and Kaposi sarcoma being additionally recorded in hospital outpatient children. In contrast to previous findings molluscum contagiosum lesions were not observed in institutionalized children. Neither NOMA nor lymphadenopathy were documented in this study, despite Naidoo and Chikte having recorded the latter in just less than half (47%) of their subjects.

**Objective 3: Association between the presence of mucosal lesions and CD 4 cell counts among the hospital outpatient department children**

There was no statistically significant difference ($p = 0.82$) in mean CD4 counts between children on HAART and those not on HAART. This study does however confirm that HAART does increase the CD4 cell count. Data from 82% of the children on HAART showed an increase in the mean CD4 count from <200 cell/mm$^3$ to 868 cell/mm$^3$. Government policy at the time of this study directed that HAART therapy be initiated at a CD4 count <200 cell/mm$^3$.

There was no significant difference ($p = 0.21$) in the prevalence of oral lesions in patients with a CD4 count <200 cell/mm$^3$ and those with a CD4 count >200.

Contrary to expectations, this study did not find an association between the level of immunosuppression and oral lesions. The reason for this is not clear but it may be related to the fact that patients with a CD4 count <200 cell/mm$^3$ constituted merely 13% of the study sample.
HAART use was associated with a decreased prevalence (\(p = 0.03\)) of oral lesions in patients with a CD4 count <200. The present findings seem to be consistent with other research which found that whilst a CD4 count <200 cell/mm\(^3\) predisposes towards the expression of oral lesions,\(^{26,27}\) the administration of HAART reduces their occurrence.\(^{28}\)

HAART use may be associated (\(p = 0.051\)) with a decreased prevalence of oral lesions in patients with a CD4 >200. These results suggest that HAART use may be associated with decreased prevalence of oral lesions in patients with a CD4 >200. This finding is consistent with the conclusions of other studies.\(^{29}\)

Objective 4: Comparison of the prevalence of oral mucosal lesions among the hospital outpatient children between those on HAART and those not receiving HAART

The prevalence of oral lesions was significantly reduced (\(p = 0.025\)) in children receiving HAART.

The findings of the current study do not support previous research,\(^{30}\), which reported no change in the occurrence of oral lesions in children receiving HAART. This rather contradictory result may be due to the fact that this study used a relatively large sample size. Previous studies used small sample sizes which may have had inadequate power to detect an existing important effect. It is possible; therefore, that HAART use is indeed associated with a decreased prevalence of oral lesions. Further work is required to establish this.

This reduction was attributed to a reduction in oral candidiasis.

This finding further supports previous research which found that HAART plays an important role in controlling the occurrence of oral candidiasis.\(^{5,31}\)

CONCLUSION

In the present study, the incidence of oral lesions and dental caries were significantly higher in hospital outpatients than in institutionalized children. Caries prevalence was significantly higher in children receiving HAART than in those not on HAART.

Acknowledgement: The authors would like to thank the Programme Director Prof E Blignaut for her contribution and Prof H Schoeman for his assistance in analysing the data.

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8. Epi Infologprogram.3.3.2 version, 2005.
Percutaneous Exposure Incidents – prevalence, knowledge and perceptions of dental personnel and students at a dental training site in KwaZulu-Natal

ABSTRACT
Healthcare workers, including dental practitioners and dental students, are at risk of occupational exposure to blood-borne pathogens such as hepatitis B, C and HIV. The present study set out to determine the prevalence, knowledge, management and perceptions of percutaneous injuries among staff and students at a dental training institute in Durban, KwaZulu-Natal with a view to identifying policies aimed at reducing the incidence. The prevalence of percutaneous injuries experienced by dental staff and students from 2001 to 2011 was determined. The levels of knowledge and their management of percutaneous injuries were determined among current dental staff and students. The dental department sustained 40% of total Hospital injuries, and of these 76% were suffered by students and 24% by staff. 22% of the sample had sustained a percutaneous injury, and of these, 57% had endured more than one and 24%, three or more injuries. Most current respondents had reported the incident (81%) and had taken the initial dose of post exposure prophylaxis; however, only 22% had taken the medication for the recommended period of four weeks. Avoiding percutaneous injuries by adopting safe work practices is probably the best practice to prevent transmission of blood-borne infections such as Hepatitis and HIV.

INTRODUCTION
Healthcare workers (HCW) are on a daily basis at risk of exposure to blood-borne pathogens through percutaneous exposure incidents (PEI). "Percutaneous exposure incident" is a broad descriptive term that includes needlestick and injury with a sharp object, as well as cutaneous and mucosal exposures to blood, saliva, tissue and other bodily fluids that are potentially infectious. Nurses, physicians, surgeons, laboratory workers, dental and medical personnel, and students in clinical training are considered high risk categories. Oral health care workers are particularly vulnerable as the dental environment is unique when compared with other health care settings due to the oral cavity being a small operating field, the close contact that is required between dental personnel and the patient during procedures, the possibility of sudden movements of the patient, the use of sharp dental instruments and the likelihood of direct or indirect contact with traumatized tissues, saliva and blood, all on a daily basis. Furthermore, collisions with sharp objects can occur due to the close positioning of the instrument delivery system which houses the handpieces, most probably fitted with pointed burs, and handily placed to effect injury when the operators themselves move without care.

The literature has shown that the common site of injury is one of the fingers on the non-working hand which plays a supportive role in dental procedures. Other areas include the arm, palm, thigh, leg and foot. The nature of the injury can be superficial (scratch without bleeding), moderate (broken skin with bleeding) or deep (needle stick or deep cut with or without bleeding). Mucous membrane exposure is another risk wherein blood, body fluid or tissue comes into contact with the...
eye, nose or mouth. Aerosols created during dental procedures with the use of high-speed handpieces and ultrasonic scalers as well as flying chips of calculus during scaling, or of amalgam during restorative procedures, or of fragments of tooth and bone during surgical procedures, can easily penetrate the eye, nose and mouth if there is no proper protection. Non-intact exposed skin that is chapped, abraded or previously injured is also susceptible to percutaneous exposure injuries.

Most injuries occur during oral surgery procedures (35%), 19% during restorative work, 13% in hygiene procedures and 9% are associated with periodontal surgery.\textsuperscript{5} Research indicates that the majority occur as a result of an accident with the dental syringe during the administration of a local anaesthetic.\textsuperscript{4,6}

The reported prevalence of percutaneous injuries among dental students ranges from 20%-80%.\textsuperscript{4,7-10} Students are at a higher risk due to their inexperience in handling clinical instruments and infection control procedures\textsuperscript{5} and by the pressure occasioned by the need to complete a set number of clinical case requirements to the satisfaction of the supervisor.

A percutaneous exposure incident places a healthcare worker at a significant risk of blood-borne infections that can be transmitted from the patient. Hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus (HIV) are the blood-borne pathogens of concern. Other infections that can be transmitted through PEI include syphilis, malaria and herpes.\textsuperscript{11} HBV is more readily transmitted in the dental setting. The World Health Organization estimates that of the global burden of disease among HCW's, 40% of the hepatitis B and C infections and 2.5% of the HIV infections are attributable to exposures at work.

The risk of contracting disease from a single percutaneous exposure to HBV-infected blood can range from 6% to 30%\textsuperscript{12} depending on the presence of hepatitis B e antigen (HBeAg) in the source individual. A safe and effective vaccine against HBV has been available since 1982 resulting in a dramatic reduction of the prevalence of HBV.\textsuperscript{11}

The estimated risk for infection after a percutaneous injury and exposure to HCV-infected blood is 0%-7%.\textsuperscript{10} The risk from a blood splash is believed to be very small; however HCV infection from such an exposure has been reported.\textsuperscript{13}

Symptoms of HCV often do not emerge for 20-30 years after viral transmission occurs and the disease may be undiagnosed for protracted periods. Moreover, there is still no effective vaccine or post-exposure prophylaxis against HCV.\textsuperscript{11}

The risk of transmission of HIV from a sharps injury is less than 0.3% (stated in another way, 99.7 percent of exposures do not lead to infection) and the risk after exposure to the eyes, nose or mouth is 0.09%.\textsuperscript{14} Several factors, though, can influence the risk of transmission. These include a deep injury, a hollow-bore blood-filled needle, the quantity of blood, visible blood on the device, high viral titre status of a newly infected patient or those in a terminal state, and prolonged exposure to the blood of a patient as well as high susceptibility of the exposed person.\textsuperscript{15} Taken together, these factors can increase the risk of HIV infection to 5%.\textsuperscript{11} As the prevalence of HIV in sub-Saharan Africa is the highest in the world (22.4 million people living with HIV),\textsuperscript{16} the potential for local health care workers to be exposed is high.\textsuperscript{17}

During the last few decades, strategies such as hepatitis B vaccination, adoption of standard precautions, improved instrument design such as safety needle devices, worker education and training and the utilization of personal protective equipment have been implemented in the endeavour to reduce percutaneous injuries.\textsuperscript{11} Despite these attempts the problem still persists among health care workers, placing a significant emotional and psychological toll on the occupationally exposed.

The KZN Oral and Dental Training Centre (ODTC) is located within a provincial hospital and is the site for the clinical training of dental therapy and oral hygiene students at the University of KwaZulu-Natal (UKZN). The province has the highest burden of HIV/AIDS infected and TB patients in South Africa and students and staff are in contact on a daily basis with patients who are carriers of potentially infectious diseases such as HIV, tuberculosis (TB) and hepatitis.

The aim of the present study was to determine the prevalence, knowledge, management and perceptions of percutaneous injuries among dental staff and students at the KZN Oral and Dental Training Centre by

1. recording the frequency of occurrence of needlestick and sharps injuries experienced at the Oral and Dental Training Centre through a retrospective analysis over a period of time (2001-2011), and further to:

2. determining the knowledge of current dental staff and students on the clinical management of such injuries and their perceptions through a cross-sectional study and by comparing current Departmental policies and clinical protocols with the recommended universal/standard precautions on the management of percutaneous exposure injuries.

**METHODOLOGY**

Information for the retrospective study pertaining to percutaneous injuries at the Oral and Dental Training Centre from 2001 to 2011 was accessed from entries made in a log book kept at the staff clinic in the main hospital in which details of all such incidences were recorded. Statistics of all health care workers were therefore available. Data specific to the dental department was captured on a structured collection sheet.

A cross-sectional study used a self-administered questionnaire to determine the knowledge, management and perceptions of percutaneous exposure incidents among current dental staff and students. Information was collected regarding the understanding of percutaneous injuries, infection control practices, the reporting of the incident and the use of post-exposure prophylaxis. The sample was drawn from the dental clinical staff at ODTC (dental therapists, oral hygienists and dental assistants) and dental therapy and oral hygiene students from UKZN. Each individual, staff or student, was personally approached and invited to participate, having been informed that participation was voluntary. A stratified random sampling method based on the extent of clinical experience was used to divide the student study population (n=90) into sub-groups and a random sample was taken from each sub-group. Hence, the student sample included mainly second and third year students (n= 47) with a
small selection (n=13) of first year students whose clinical exposure was observation of dental procedures. The final sample comprised 40 members of staff and 60 students for a total of 100 and was viewed as representing the combined experience of those involved in the discipline. The response rate for staff was 93% and for students, 88%.

In addition, the current Hospital policy regarding percutaneous exposures was evaluated in comparison with a list of gold standard criteria as recommended by the Centre for Disease Control (CDC) for the management of percutaneous injuries.1

Ethical clearance for the research was obtained from the University of Western Cape (Ref No. 11/4/27). The data was captured in MS Excel, basic descriptive analyses completed and the files were imported into SPSS version 20.0 for further assessment.

RESULTS

Log book data
Over the study period from 2001 to 2011, 178 percutaneous injuries were recorded at the King George Hospital in which the ODTC is situated (Table 1). The personnel from ODTC sustained the most number of percutaneous injuries (n=72) followed by the nursing staff (n=61) and medical officers (n=22).

Given that every injury in fact had been reported in the logbook maintained at the staff clinic, the risk of dental staff and students suffering percutaneous injuries was 0.4 (72/178) when compared with other categories in the Hospital. This meant that out of every ten injuries recorded in the logbook, four had been sustained by dental personnel who therefore had a higher probability of incurring a percutaneous injury than did other cadres of health workers in the Hospital. The risk for medical officers was 0.1 (22/178).

Over the study period, Dentistry incurred an average of 6.5 injuries per year (Table 1: 72/11 = 6.5). Dental students had a high prevalence of percutaneous injuries, constituting 76% of all Dental Hospital incidences with a mean of five injuries reported per year. The prevalence of percutaneous injuries among dental staff (dentists, dental therapists, oral hygienists and dental assistants) was 24%.

The current sample
The cross-sectional study was conducted on a mixed sample which included both dental staff and students and in which the greater proportion were females (Table 2)

Analysis of the self-administered questionnaire among this sample revealed that the majority of the study population had a good understanding of percutaneous injuries with more than half (56.2%) defining this as “where a practitioner has accidentally pricked/injected themselves with a needle, scaler or other sharp, infected instrument” and almost 15% indicated that they thought it was “a visible injury when there is a breach in the epidermis, affecting underlying blood vessels resulting in bleeding.” Most of the respondents (83%) recorded that they adhered to the practice of standard precautions when treating patients. Almost three quarters (74%) of those having had a PEI had previously completed three doses of the Hepatitis B vaccine, but only 41% had checked whether they had any immunity after taking the vaccine. More encouragingly, 44% reported having had a booster vaccine.

Amongst the current staff and student cohort, 22% reported having sustained a percutaneous injury. Of these, 43% had experienced at least one, more than half (57%) had suffered more than one injury and almost a quarter (24%) had experienced three or more PEIs (Figure 1).

More than a third of the injuries (33.3%) were due to mishaps with the dental syringe and needles (Table 3). Injuries associated with the use of the dental elevator and eye splashes were also common (16.7% each).

Most percutaneous injuries (63%) were caused during a minor oral surgery procedure (Table 4). Nearly two-thirds (63%) of the injuries occurred to the finger, especially when a minor oral surgery procedure was being performed (40.7%).
Two out of every three incidents (66.7%) occurred during, and a quarter (25%) occurred after, the dental procedure, during the cleaning up process. Oral health care workers reported considerable emotional distress, displaying reactions of anxiety, fear, sadness and anger and some were totally devastated. Anxiety was the most common emotion reported by nearly quarter of the sample (Figure 2).

Most respondents had reported the incident (81%) and those that had not had considered the injury too small to be of any significance, or that the source patient had been shown to be HIV negative whilst some thought there was no risk of infection or were unaware that they had to report the incident. Almost all the respondents who sustained and reported percutaneous injuries (94%) took the post exposure prophylaxis (PEP), however only 22.2% had taken the medication for the recommended period of four weeks.

More than half of the respondents (55.6%) had taken the PEP for between two to four weeks. Only 13.6% of those that incurred a percutaneous injury had the recommended full series follow-up blood tests and 18% did not have any follow-up blood tests at all.

Most of the respondents (86%) had received pre-test counselling, 68% received post-test counselling but only 23% had any follow-up counselling after an injury (Figure 3).

A structured data capture sheet was used in the evaluation of the ODTC policy for the management of percutaneous injuries (Department of Health Guidelines on Standard Precautions, Chapter 15). The policy adopted by the ODTC is in keeping with recommended international guidelines for the management of percutaneous injuries (CDC, 2005) with a clearly defined aim, a designated occupational health officer and good referral systems in place. Post exposure prophylaxis is made available. Students are made aware of this policy during orientation at the beginning of each academic year.

Although the ODTC policy is in keeping with international guidelines, the following shortfalls were noted:
- The protocol is not clearly displayed on notice boards for staff and students to follow.
- There is very little in-service training offered.
- There is no induction training for new staff.
- Follow-up of student and staff after an injury is not ensured or monitored.
- There is no process for follow-up counselling.
- There is no monitoring or regular review of the policy.

**DISCUSSION**

By analyzing and investigating the causes of injuries, useful information may be gleaned. Information regarding the circumstances surrounding the reported injury may be valuable in preventing further injuries by modifying work practices. The needle was the most common source of injury among dental students and staff (33.3%). This finding concurs with previous studies which reported the syringe needle to be associated with 30-36% of all percutaneous injuries at a dental training institute.3,4,8,16,19-21

Most injuries occurred when the needle was being withdrawn from the patient’s mouth, while recapping the needle and when removing the used needle from the syringe.

| Table 3: Cause of injury: current sample |
|-----------------|---------|---------|
| Cause           | Percent | Frequency|
| Needle          | 33.3    | 10      |
| Surgical elevator | 16.7    | 5       |
| Eye splash      | 16.7    | 5       |
| Scaler          | 13.3    | 4       |
| Bur             | 10.0    | 3       |
| Explorer        | 3.3     | 1       |
| Patient bit my finger | 3.3    | 1       |
| Matrix band     | 3.3     | 1       |

**Figure 2:** Reaction after an injury

**Figure 3:** Counselling received by the exposed sample

<table>
<thead>
<tr>
<th>Table 4: Type of procedure and injury site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor oral surgery n (%)</td>
</tr>
<tr>
<td>-------------------------</td>
</tr>
<tr>
<td>Finger</td>
</tr>
<tr>
<td>Thumb</td>
</tr>
<tr>
<td>Eye</td>
</tr>
<tr>
<td>Thigh</td>
</tr>
<tr>
<td>Foot</td>
</tr>
<tr>
<td>Palm</td>
</tr>
<tr>
<td>TOTAL</td>
</tr>
</tbody>
</table>
Current safety measures recommended are the use of the “one-handed scoop technique” to recap used needles, placing a sharps container in each cubicle in the clinic to avoid staff walking around with contaminated needles and not removing needles using the hands but rather using an instrument such as artery forceps. This may advantageously be attached to each sharps container. In addition to these measures, a device can be placed on the work surface that holds the needle sheath and allows for recapping without touching the sheath or adopting the use of a safety syringe that has a sliding protective sheath over the needle. Another method of reducing accidents due to needles is the use of an incinerator in which the needle is completely incinerated after use leaving only the plastic hub which can then be harmlessly removed. These work practices are in keeping with the current CDC guidelines which recommend that used needles should never be recapped, purposely bent or otherwise manipulated.22

The surgical elevator was the instrument most often associated with injuries (16.7%) and it was also that most frequently contaminated with blood when the injury occurred. Mucosal eye splashes accounted for nearly a fifth of all percutaneous exposures (16.7%) which is suggestive of inadequate eye protection during dental procedures. These results are slightly higher than those found in the study by Siddiqi in 2008 (Coupland elevator 14%, mucosal eye splashes, 15%).4

Most of the injuries occurred while the operator was performing minor oral surgical procedures, followed in frequency by scaling and polishing and restorative procedures. Cleveland et al.3 also found that while most percutaneous injuries occurred in oral surgical procedures, whilst the findings for other procedures differed: 19% of injuries were related to restorative procedures and 13% to oral hygiene procedures. Injuries occurring during minor oral surgical procedures can be reduced by strictly adhering to the latest standard precautions of double gloving and the use of blunt-tip suture needles as an alternative to the sharp product currently used. Blunt-tip suture needles have been shown to reduce needlestick injuries by 69.21

The present study, in agreement with similar studies conducted in South Africa,4 showed that the finger of the non-dominant hand that plays a supportive role was the most common site of percutaneous injuries, followed by the eye.

Management of PEI
Percutaneous injuries were found to be appropriately managed at the ODTD. Eighty percent of the respondents who had sustained such an injury had reported the incident. This observation is commendable as previous studies have documented under-reporting as a universal problem.24,25 In addition, 70% of those who had sustained a percutaneous injury had sought medical attention at once. The transmission of HIV infection does not occur immediately on exposure, therefore the timeous initiation of post-exposure prophylaxis creates an opportunity for the antiretroviral drugs to modify or prevent viral replication thereby preventing systemic infection. Treatment should commence promptly, preferably 1-2 hours after the exposure and not later than 72 hours.1

Post-exposure prophylaxis is made available to both staff and students at the staff clinic in the hospital. A basic regime of two nucleoside reverse transcriptase inhibitors (NRTIs) is prescribed and a protease inhibitor (PI) is given if the risk for transmission of HIV is considered high. The CDC recommendations state that a combination of Zidovudine (AZT 200mg every 8 hours) and Lamivudine (3TC 150mg b.d.) for 28 days should be considered for treatment of all exposures involving HIV-infected blood, fluid containing visible blood or other potentially infectious fluid or tissue. Indinavir should be added to this regime for high risk exposures. It was of concern, though, that there was poor final compliance as only 22% of those incurring a percutaneous injury had completed the recommended regime. Siddiqi et al.4 also reported a low compliance to post exposure prophylaxis (7%). An important aspect of post exposure prophylaxis is the completion of a four week course of anti-retrovirals when indicated.1 One of the reasons given for not completing the post exposure regime was not being able to cope with the side effects of the medication, about 46% of which included gastrointestinal problems, the medication making them feel sick, tired and nauseous.

It was also of concern that very few participants in the present study had follow-up testing. Occupational health and safety is an important issue in the work environment. Staff and students who are in the pre-employment phase should be educated about the importance of follow-up blood tests to check for sero-conversion. It is advisable for all staff and students who suffer a percutaneous injury to diarise their test dates and ensure that the follow-up tests are carried out timeously. At least the six month follow-up test should be done. It is also good practice for all health care workers working with blood to have an annual blood test.

In the present study, only a small cohort of the exposed population had received follow-up counselling. A percutaneous injury can impact negatively on a health care worker’s personal life causing anxiety, fear and depression. The emotional distress can be severe and long lasting even though the risk of transmission is very low or there may be no transmission of serious disease. Therefore post-exposure counselling is needed. However, this is not yet available at the Hospital as a routine option. An important lesson learnt from the current study is that a supportive environment and careful monitoring of the dental personnel after a percutaneous injury are important for total rehabilitation and readjustment to the work environment.

The following recommendations are suggested to prevent PEIs in dental training institutions:

• Protocols to be followed in the event of a percutaneous injury should be clearly displayed in the clinical areas;
• Percutaneous injuries should be carefully recorded and those records should be reviewed annually as an effective tool to determine the aetiology and to make the relevant changes to work practices to prevent further injuries;
• The use of personal protective equipment (double gloves, mask and eye-shields) for every procedure should be reiterated;
• Adherence to safe work practices such as using the one-handed scoop technique to recap needles or a
mechanical device that holds the needle cap should be encouraged;

- In addition to the adoption of safe work practices, institutions should identify, evaluate and select safety devices such as needle incinerators, needle guards and safety syringes for routine use.
- In-service training of safe work practices should be provided upon initial employment and when staff first enter the clinical area and should be followed by continuous education on an annual basis to keep updated with current safe work practices and work modifications, and in the promotion of safety and prevention awareness to reduce or prevent percutaneous injuries.

CONCLUSION

A percutaneous exposure incident is a serious occupational health hazard that places dental staff and students at risk of transmission of blood-borne pathogens. The current study shows that percutaneous injuries are an ongoing problem at the ODTC and highlights the fact that dental personnel are at a higher risk of suffering percutaneous injuries than other health professionals working at the King George Hospital. High risk activities have been identified, enabling recommendations on modifications of work practice to reduce the incidence of percutaneous injuries at the ODTC. Accidents are sometimes unavoidable but attending to a percutaneous injury as soon as it occurs, treating it as a medical emergency and following through with the management protocol are of utmost importance to prevent the transmission of blood-borne diseases. It is of concern that the present study revealed that personnel do not comply with management protocols regarding completion of post-exposure prophylaxis and follow up tests.

Conflict of interest: None declared

References

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• Helps prevent new stains forming
• Protects against plaque bacteria
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- Protects against plaque bacteria
- Fluoride helps strengthen teeth

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Opportunities for Teledentistry in South Africa

JB Fortuin¹, S Naidoo²

ABSTRACT

Information, communication and technology (ICT) is a part of everyday life, and the constant evolution of technology has resulted in many opportunities for the health care sector. While health professionals globally have embraced the use of ICT to assist in the delivery of health care services and education there remains a lack of scientific evidence to support the practice. The uptake of ICT in low and middle-income countries has been slow, despite the fact that this is where a great need for innovative solutions is required to improve the delivery of health care services. ICT for health is being used throughout South Africa with promising results, and there is potential for the use of ICT in the field of Dentistry. This paper provides a background of ICT for health by highlighting the applications of telemedicine, teledentistry and mHealth and examples are given of the various uses of ICT in the various disciplines of Dentistry. The benefits and challenges of teledentistry are documented and recommendations about the use of teledentistry in South Africa are discussed.

Key words: Telemedicine, Teledentistry, Teleradiology, mHealth, eHealth

INTRODUCTION

Low and middle-income countries account for the highest disease burden and are faced with the challenge of being under-resourced in terms of human and financial factors.¹,² While Africa accounts for only 10% of the world’s population, it has 25% of the global disease burden and 3% of the entire global health workforce.³ Despite the relatively high national expenditure on health services, the health status of the South African population compares very poorly with that of many other countries.⁴ The South African Government, with the assistance of various international organizations, has made many attempts to address the various challenges faced by the South African health system (e.g. shortage of skilled and specialized health professionals, inaccessible health care and overburdened health system) by implementing numerous short, medium and long term measures. Among others, eHealth has been identified as a potential tool for addressing some of the challenges.

The provision of oral health services in South Africa has its challenges. One of these includes a lack of human resources - there are 2.19 dentists per 100 000 population and 0.28 dental specialists per 100 000 population.⁵,⁶ Oral diseases prevalent in the country include dental caries, periodontal disease, oral mucosal lesions, oro-pharyngeal cancers, HIV/AIDS and oro-dental trauma.⁷ Oral diseases are the most common of the chronic diseases and their impact on the quality of life of an individual and subsequent impact on society is high.⁸ According to the World Health Organisation (WHO) dental caries is one of the major public health problems impacting on the lives of 60-90% of children globally.⁹ The identification of the oral health service challenges and oral disease provides an opportunity for the development of innovative ICT solutions, such as teledentistry.

South Africa’s dental health service has been plagued by a lack of access to health care, and unequal distribution of human resources for health. There have been no reported innovative ideas or solutions implemented using information and communication technologies (ICT) for the barriers affecting dental health services.¹⁰ There are only a few dental specialists in South Africa and most work in the private sector in urban areas.

Teledentistry is the use of ICT to allow for the interchange of clinical data including images over remote distances for dental consultation and treatment planning.¹¹ Countries like Ireland have embraced the use of teledentistry where innovative approaches to triage oral medicine referrals not only support practitioners in rural areas but also decrease the potential waiting time for consultations.¹²

This review provides a definition of teledentistry and describes its potential applications. The benefits and challenges are discussed and recommendations are made regarding the possible uses of teledentistry in the South African context.

ACRONYMS

ICT: Information, Communication and Technology
NDoH: National Department of Health

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DEFINING TELEMEDICINE AND TELEDENTISTRY

The prefix “tele” in Greek means “at a distance”, and the meaning of “telemedicine” has been widely interpreted as consisting of any medical activity that is performed by two or more parties, separated by distance. A comprehensive definition of telemedicine, which was published in 2007, following a review of 104 peer-reviewed definitions, reads as follows: “Telemedicine, being a subset of telehealth, uses communication networks for delivery of health care services and medical education from one geographic location to another, primarily to address challenges such as inequitable distribution and shortage of infrastructural and human resources”.13 Telemedicine is referred to as the use of information and communication technology (ICT) to provide health care service and delivery when distance separates the participants concerned.14

In 1997, teledentistry was referred to as the practice of using videoconferencing technologies to diagnose and provide advice about treatment over a distance.15 A more recent definition is the “use of dental information transmitted from one site to another to improve oral health”.16 An all-inclusive teledentistry definition in keeping with current advances is described as the use of ICT in dentistry for oral health services and education,17 and encompasses all ICT including dental information systems and dental records, as well as the educational aspect (undergraduate, postgraduate and continued professional development) and oral health promotion.

TELEDENTISTRY

The field of teledentistry has grown rapidly with the evolution of technology. The benefits of teledentistry include increased access to oral health information, online tools for record keeping, assisted diagnosis and monitoring, electronic records and charting, remote screening, skills training, continued learning and support.18 It is used widely in developed countries and its advantages include decreasing unnecessary dental referrals especially for orthodontic services.19 Teledentistry has been used successfully as an intervention system for periodontal health, as well as for the early diagnosis of oral diseases.20,21 Two key advantages of teledentistry involve access to dental specialist services and enhancement of dental education using distance learning techniques.22

Cost savings or economic benefits are important for all aspects of health care and teledentistry not only saves costs, but also decreases waiting times to access specialists.23 More remote areas were more likely to benefit from teledentistry.24 An economic evaluation in the Scottish Highlands and Islands found cost saving benefits. However these were dependent on certain parameters including familiarity with the equipment being used.

Teledentistry has been described as “new”, “seductive” and a “superficially easy-to-use technology” and the assumption is that clinicians will use it and patients will accept it.25 As with any new technology, there are associated limitations and barriers including compromising the relationship between the health professional and patient, breakdown in the relationship between health professionals, validity of information, organizational and bureaucratic difficulties.26

In addition, teledentistry has raised ethical and medico-legal concerns. However, ethical and legal principles do not change for telemedicine interactions (e.g. teledentistry) and should remain the same as for conventional face-to-face consultation. Patients are often concerned about privacy and confidentiality of their personal information and are reluctant to divulge these details or participate in teledentistry initiatives. Another growing concern among patients is not so much related to access to their information but rather that their information could be altered.27 The need to address the concerns over security and confidentiality cannot be overemphasized as this could have a detrimental effect on future acceptance of teledentistry.28

Many health professionals have been resistant to technology. Some perceive that the technology will replace them while others feel that they will be economically comprised. Rural physicians perceive it as a threat to their livelihood as urban physicians will have access to their patient pool.29 In addition, health professionals often feel that it is foist upon by management - the “top down approach”. Technology in health should have a “bottom up approach” where the health professional is an integral part of the planning and policy development of the implementation of a teledentistry system.30
The following provides a comprehensive overview of the various applications of teledentistry.

SCREENING

Teledentistry screening services have become the chosen method of screening to ensure that dental problems are identified before they become dental emergencies, and to assist children and their families better access to connect with health services. In Rochester, New York, within thirteen inner city child care centres, a telehealth centre was set up to perform oral screenings. It utilized an intraoral camera to take digital images of children’s teeth that were transmitted to the Eastman Department of Dentistry, University of Rochester. Nearly half of children examined were diagnosed with dental caries and prompt feedback was provided regarding follow-up dental care. A similar service could be beneficial in South African healthcare settings, where school nurses could be provided with basic training and the necessary equipment to conduct oral health screening services at schools. The information would be sent to oral health professionals who are able to assess the cases and allocate it to the necessary specialist. This simplistic service could have positive implications such as avoiding unnecessary referrals, decreasing waiting time for dental treatment and saving costs.

EXPERT ADVICE

Providing expert oral health advice in a resource-constrained setting like South Africa is beneficial. Several expert oral health advice initiatives have been reported in the literature. One such initiative was at a primary care clinic in Brazil, where digital images of oral lesions were sent via email to two oral medicine specialists who showed a 60% agreement on the diagnoses. The authors recommended that distant diagnosis can be an effective approach especially when there are no local specialist services.

In 2004 in Arizona, dental hygienists were allowed to enter affiliated practice with a dentist to provide oral health services without direct supervision. This prompted the Northern Arizona University to develop a teledentistry-affiliated practice dental hygiene model. The purpose was to provide oral screening and appropriate teledentistry dental hygiene services for children participating in ‘First Things First’ health care event. The activities took place at remote sites within Arizona and children were screened and referred to dentists. This model was easy to implement with existing technologies and offered oral health services to underserved populations. Patients were positive as it not only saved them unnecessary travelling, time off from work or school, but also allowed for quicker access to specialists. Furthermore, the dental hygienists also felt more empowered.

EDUCATION AND ORAL HEALTH PROMOTION

An important area which should be further explored is the use of information and communication technology for oral health promotion and education. eLearning has been implemented in health sciences with great success and the dental fraternity could draw from these valuable lessons. The expectations of Fourth year dental students regarding eLearning were evaluated by means of questionnaires and comparing online tests to traditional examinations. Students indicated that they expect the quality of studies to improve and online tests would be beneficial for self-performance rating. The Paediatric Dentistry Department at the University of the Western Cape, Cape Town, South Africa implemented an online learning platform to supplement didactic and clinical teaching. Most of the students accessing the online platform gave positive feedback.

Social media, internet and mobile applications provide opportunities to disseminate oral health information in a more user-friendly and cost-effective manner. The use of text messaging and pamphlets was compared to determine the value in distributing health education to mothers of preschool children. Pre- and post-intervention assessment involved evaluating the knowledge, attitude and practices of mothers and assessing the plaque levels of their children. Text messaging had a greater positive impact on knowledge, attitude and practices of mothers than the use of conventional pamphlets. However, there was no significant difference when comparing the reduction in plaque scores between the text messaging and pamphlet groups. Short Message Service (SMS) has also been used as patient reminders with the aim of improving dental appointment attendance and were found to significantly reduce the non-attendance.

ORTHODONTICS

It has been shown that orthodontic services can be made accessible to disadvantaged children through sufficiently prepared dentists who are supervised remotely by orthodontists. In the UK, orthodontist consultants were surveyed regarding how they would feel about providing orthodontic advice to dental practitioners via electronic means and the majority supported the idea. Furthermore, new orthodontic patient referrals using the teledentistry system as a screening platform has also been shown to be effective. This was demonstrated by a randomized controlled trial in the UK. Fifteen dental practices in Manchester were randomly allocated to either a test group (n=8) or control group (n=7). During a 15-month period 327 patients were referred to two consultant orthodontists. In the test group dental practitioners took photographs of the patients to be referred and sent these images via email to one of the two consulting orthodontists using the “store-and-forward” method. This process in telemedicine involves the non-interactive transmission of information from one site to another. The same patient was seen in a new patient clinic – “conventional” – and the outcomes of the two methods of consultation were compared. In the control group, patients were referred using a referral letter. In the test group there were only 8.2% unnecessary referrals whereas in the control group there were 26.2% unnecessary referrals. The study highlighted the advantage that unnecessary referrals could be avoided and visits to specialists can be reduced, especially where hospitals are far from the rural areas.

TELERADIOLOGY IN DENTISTRY

Radiology equipment is expensive but a vital tool to assist with diagnosis. Most radiology equipment is digitized and used extensively to save costs. The use of teleradiology in dentistry has had an ambivalent reaction from dental practitioners and specialists with regards to its reliability. Baker et al (2000) compared radiographs transmitted and viewed using a video teleconferencing system with the images seen on a conventional view box. Two endodontists assessed 30 images for the presence of apical lesions. There was
no statistical difference between the evaluators identifying periapical bone lesions using the conventional radiographs or those transmitted on a screen.\textsuperscript{42} While this study supports the use of teleradiology in dentistry, a comparative study undertaken by Jacobs, EDMonton and Lowry (2002) suggested that teleradiology should be used selectively. Ten facial radiographs with fractures and 10 without fractures were evaluated by eight oral and maxillofacial surgeons and eight accident and emergency doctors. The fractures were accurately diagnosed using plain radiography whereas the diagnosis using telemedicine was poor.\textsuperscript{43}

**TELEMEDICINE IN SOUTH AFRICA**

The first known telemedicine initiative in South Africa dates back to 1998, when the first phase of the implementation of South African telemedicine began, guided by the National Strategy for Telemedicine. The objectives of the strategy focussed on providing high-quality and cost-effective health care and education, improving recruitment and retention of health professionals, delivering health care at a distance, and making specialist health care much more accessible than it had been in the past.\textsuperscript{44} The South African Government identified telemedicine as a crucial strategic initiative to improve the delivery of equitable health care and services. The Medical Research Council (MRC) and the South African National Department of Health (NDoH) initiated the Telemedicine Lead Programme in 1999. The purpose of this joint partnership was to ensure that relevant research was conducted that will inform the sector and to coordinate the telemedicine environment. In the past decade over eighty-eight telemedicine projects were initiated by the NDoH and implemented in various parts of South Africa.\textsuperscript{45} The majority of them are now defunct, mainly due to lack of funding. It was anticipated that the telemedicine projects would be integrated into routine health service provision. However, such integration has not occurred. Only a few telemedicine services at provincial level are still functioning, such as telediagnosis and teledermatology.

**RECOMMENDATIONS FOR SOUTH AFRICA**

This review has shown that there have been many successful initiatives globally that describe the benefits of teledentistry, some of which could be implemented in South Africa where appropriate. Common challenges in oral health service delivery include undiagnosed oral health diseases and inaccessible oral health services,\textsuperscript{46-48} and therefore it would be beneficial to implement basic teledentistry screening initiatives targeting school learners, the elderly, physical and mentally challenged individuals and health-compromised individuals. Such services could be provided at minimal cost in terms of infrastructure and equipment. In addition, improving the availability of specialist services for patients could strengthen the South African health system by reducing cost, enhancing quality of life, decreasing unnecessary referrals and decreasing long waiting times. Teledentistry is a potential solution to make dental services in most rural areas in South Africa more accessible.

South Africa has not been successful in the implementation of telemedicine and the reasons for this are varied. However many lessons have been learnt and technology has evolved and improved. The NDoH has embraced the use of ICT’s and one such example has been the successful implementation of MomConnect. After the assessment of previous ICT projects, government officials, academics and ICT for health researchers investigated mechanisms to ensure sustainable scalable ICT solutions for health. Various working groups and committees were initiated and a substantial amount of progress has been made towards the development of an eHealth and mHealth for South Africa.

Health professionals, decision makers and academics can no longer continue to work without embracing technology. Technology is rapidly evolving and providing smarter, more effective hardware and software. However, while technology will never replace the need for face-to-face contact with a health professional, ICT4H, eHealth and teledentistry are ways of enabling oral health service delivery and education, and potentially improving health outcomes and service delivery.

**Conflict of interest:** None declared

**References**

ABSTRACT

Aim: Discolouration of direct composite resin restoration poses a significant aesthetic problem. This study compares the staining capacities of various beverages on direct composite materials, and compares the stain removing abilities of in-office bleaching using 38% Hydrogen Peroxide (Opalescence Boost) and re-polishing with Sof-Lex polishing system (3M ESPE).

Materials & Methods: 180 composite resin specimens were prepared, incubated and immersed in six staining solutions: tea, tea with sugar, coffee, coffee with sugar, Coca-Cola and water (control) for seven days. 90 randomly selected samples were then bleached and the remaining 90 were re-polished. Colour measurements were made with a spectrophotometer, just before immersion, after one, three, five and seven days, and after bleaching and polishing procedures.

Results: Coffee with sugar solution showed the maximum staining effect. Bleaching and re-polishing were found equally effective with no statistically significant differences observed.

Conclusion: The presence of sugar in coffee and tea solutions increases the stainability of direct composite resin. Most of the staining observed on resin composites is superficial and can be partially removed by re-polishing or bleaching procedures.

Clinical Significance: Sugar in beverages increases the staining of direct composites. Bleaching and re-polishing are equally effective in removing stains from discoloured direct composite resins.

Keywords: bleaching; composites; cosmetics; dental material; laboratory research; veneers

INTRODUCTION

Over the past two to three decades, the dental profession has witnessed a shift from restorative to elective cosmetic procedures. One of the main reasons that patients seek aesthetic dental treatment is a real or perceived discolouration of anterior teeth. Discoloured teeth can be treated with various restorative techniques such as direct composite veneers, porcelain veneers, ceramic crowns or even vital tooth bleaching. Resin composite veneers remain the treatment of choice in most cases for discoloured anterior teeth because of their excellent aesthetic properties and cost effectiveness. However, a major disadvantage is the discolouration occurring after prolonged exposure to the oral environment. Unacceptable colour match is a primary reason for replacement of composite resin restorations.

The staining of resin-based materials by coloured solutions such as coffee, tea, and other beverages, and colour stability after aging in different solutions have been reported. Studies have also shown that the inclusion of sugar into these beverages increases the colour difference as compared with the effect of beverages without sugar. Various methods such as bleaching, re-polishing and replacement of existing stained restorations have been suggested to remove the discoloration to re-establish the aesthetics of these restorations. Re-polishing appears to be the most...
popular and well reported method, even for highly stained composites, but the process removes material from the restoration surface. Bleaching procedures may therefore appear to be a non-destructive method of solving the problem. There are scant reports of how bleaching agents affect stained resin composite restorations.

This study evaluated the effects of re-polishing and bleaching on dental composite resin specimens which had been artificially stained with commercially available cola, and with coffee and tea solutions, either with no added sugar or containing a standardized amount of sugar. The CIELAB colour technique was utilised for the evaluations.

**METHODS AND MATERIALS**

180 resin composite specimen discs (Amelogen Plus A2 shade microhybrid composite resin, Ultradent, South Jordan, USA) were prepared with a height of 2.5mm and diameter of 6mm and were roughened with silicon carbide paper. These specimens were then polished dry using Soflex discdiscs (3M ESPE, Dental Products) in a slow speed handpiece with coarse, medium, fine and ultrafine discs, each grit being used for 30 seconds. The specimens were then incubated at 37ºC for 24 hours before baseline measurements were taken. The composition and manufacturers of the products included in the study are shown in Table 1.

Six solutions were prepared and the sample specimens randomly divided into six groups.

**Group I: Tea without sugar**
The tea solution was prepared by immersing 5 tea bags (Brooke Bond Tea, 5*2.6 gm) into 500 ml of boiling water for 10 minutes.

**Group II: Tea with sugar**
The tea solution was prepared as in Group I, and then 16 grams of white sugar (Parry’s refined white sugar) was added for every 500 ml.

**Group III: Coffee without sugar**
15 gram of coffee (Nescafe Classic) was dissolved in 500 ml of boiling water, and filtered through a filter paper after 10 minutes of stirring.

**Group IV: Coffee with sugar**
The coffee solution was prepared as in Group III, and the 16 gram of white sugar was added for every 500 ml.

**Group V: Coca-Cola**
Coca-Cola solution stored at 37ºC

**Group VI: Water**
Solution of tap water at 37º C, which served as a control.

For each Group the specimens were divided into lots of six, the discs placed vertically on special holders and then immersed in 20 cc of the staining solution in glass containers at 37ºC +/- 1ºC. The assembly was kept in the dark for seven days. The solutions were not agitated. At the end of one week, 90 of the samples which had been immersed in the staining solutions were randomly selected and subjected to bleaching (38% Hydrogen Peroxide, Opalescence Boost, Ultradent, USA) for one hour continuously. The remaining 90 specimens were re-polished for 30 seconds with the polishing system used earlier. Colour measurements were made just before immersion (baseline); after 1 day (T1); after 3 days (T2); after 5 days (T3); after 7 days (T4); after the bleaching procedure (T5) and after the polishing procedure (T6). Before each measurement, the specimens were cleaned ultrasonically in distilled water for 1 minute and dried with air spray.

The colour and colour difference of each specimen were measured by a spectrophotometer (X-rite spectrophotometer, X-Rite Inc, USA) (Figure 2). The measuring characteristics

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### Table 1: Products and manufacturers included in the study

<table>
<thead>
<tr>
<th>Product</th>
<th>Shade: A2</th>
<th>Filler size/content: 0.7µm, 76% by weight</th>
<th>Matrix composition: Bis-GMA</th>
<th>Manufacturer: Ultradent Product, South Jordan, UT, USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amelogen Plus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opalescence Boost</td>
<td>Content: 38% hydrogen peroxide</td>
<td>Manufacturer: Ultradent Product, South Jordan, UT, USA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soflex polishing system</td>
<td>Content: Aluminium oxide polishing discs</td>
<td>Manufacturer: 3M/ESPE Dental Products, St. Paul, MN, USA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brooke Bond tea bags</td>
<td>Manufacturer: Hindustan Unilever Limited, India</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nescafe classic, Instant coffee</td>
<td>Manufacturer: Nestle USA Inc. Glendale, CA, USA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White sugar</td>
<td>Manufacturer: E.I.D-Parry Ltd., India</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coca-Cola</td>
<td>Manufacturer: The Coca-Cola Company, Atlanta, GA, USA</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 2: Mean Delta E Values recorded in the different groups in different groups irrespective of the days.

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>SD§</th>
<th>Median</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>2.31</td>
<td>0.67</td>
<td>2.33</td>
<td>0.83</td>
<td>4.04</td>
</tr>
<tr>
<td>Group 2</td>
<td>2.54</td>
<td>0.94</td>
<td>2.42</td>
<td>0.61</td>
<td>5.00</td>
</tr>
<tr>
<td>Group 3</td>
<td>2.60</td>
<td>0.89</td>
<td>2.62</td>
<td>0.68</td>
<td>5.10</td>
</tr>
<tr>
<td>Group 4</td>
<td>2.87</td>
<td>1.27</td>
<td>2.65</td>
<td>0.96</td>
<td>9.44</td>
</tr>
<tr>
<td>Group 5</td>
<td>1.13</td>
<td>0.44</td>
<td>1.17</td>
<td>0.16</td>
<td>2.30</td>
</tr>
<tr>
<td>Group 6</td>
<td>0.81</td>
<td>0.44</td>
<td>0.72</td>
<td>0.11</td>
<td>2.62</td>
</tr>
</tbody>
</table>

§ Denotes Standard Deviation

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**Figure 1:** Comparison of Delta E values for the different groups of specimens after bleaching and re-polishing procedures.
of the spectrophotometer were standard illuminant D65, illuminating geometry d/8º and standard observer 10º. Before each measurement session, the colourimeter was calibrated according to the manufacturer’s recommendations by using the supplied white calibration standard. The discs were mounted at 90º relative to the light source. Colour measurements were made under daylight conditions and at the same time of the day. Values were recorded in the Commission International de l’Eclairage (CIELAB) colour system.

$L^*, a^*, b^*$ values of each specimen before immersion (baseline) and after all procedures were measured six times by placing each specimen on the measuring head. The values of $\Delta L^*, \Delta a^*$, and $\Delta b^*$ after six measurements were automatically calculated by the colourimeter and were recorded. Resistance to staining effects is expressed in $\Delta E^*$ units and was calculated from the mean $\Delta L^*, \Delta a^*$, and $\Delta b^*$ values for each specimen with the following formula:

$$\Delta E^* = \sqrt{(L0-LI)^2+(a0-aI)^2+(b0-bI)^2}$$

The colour changes observed between the different staining media during the study were tabulated and subjected to analysis of variance (ANOVA) and a multiple comparison test with a p value set at 0.05.

RESULTS

The Group Four specimens immersed in coffee with sugar showed the maximum colour change, followed in decreasing order by Group 3, Group 2, Group 1 and Group 5. Least colour change was observed in specimens in Group 6. Table 2 shows mean, standard deviation and range (min. and max.) of $\Delta E$ values of prepared resin composite specimens in different groups irrespective of the days. The difference in mean $\Delta E$ Values between the groups were found to be statistically significant ($P<0.001$). Multiple comparison of the $\Delta E$ values of all the specimens immersed in the different staining solutions was carried out using the Bonferroni test.

It was observed that the specimens immersed in tea with sugar solution (Group II) showed more colour change than specimens immersed in tea solution (Group I), and similarly specimens immersed in coffee with sugar solution (Group IV) showed more colour change than specimens immersed in coffee solution (Group III).

Comparison of the mean delta E values revealed a statistically significant difference in the reduction of those values from day 7 to “after re-polishing” ($P<0.001$) and from day 7 to “after bleaching ($P<0.001$) in all the groups, except in Group VI, where neither procedure was effective in significantly reducing the water stains (Table 3). The reductions in mean delta E values between “after re-polishing” and “after bleaching” were found to be statistically insignificant ($P<0.05$) in all the Groups (Figure 1), suggesting that re-polishing and bleaching were equally capable of reducing all stains from the resin composite.

DISCUSSION

Colour stability is critical for the aesthetics of permanent restorative materials. This study the effect of common beverages on the colour stability of microhybrid composite resin and the effect of in-office bleaching and re-polishing in removing these stains. The tea and coffee solutions were prepared in accord with the studies done by Guler and colleagues10 and Turkun and colleagues.2 If is accepted that the average amount of time for the consumption of a cup of beverage is 15 minutes and that the average coffee drinker consumes 3.2 cups per day, and the tea drinker 4-8 cups per day, then exposure to the solutions for a full 24 hours reasonably simulates the consumption of those drinks over one month.2 Hence sampling at 1, 3, 5 and 7 days reflects exposure over some years. This provides a suitable test for the composite resins which might become stained after a few years of being placed in the mouth.

Colour evaluation was performed using a colourimeter

**Table 3: Comparison of Delta E values after 7 days with delta E values after re-polishing and bleaching**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Time interval</th>
<th>Mean</th>
<th>SD</th>
<th>Mean difference</th>
<th>t</th>
<th>P value</th>
</tr>
</thead>
</table>
| Group I| Day 7         | 2.67 | 0.5| 1.247           | 7.505 | <0.001*
|         | After re-polishing | 1.42 | 0.36 |                 |       |         |
|         | After bleaching | 1.07 | 0.37 | 1.599           | 12.160 | <0.001*|
| Group II| Day 7         | 3.24 | 0.99|                 |       |         |
|         | After re-polishing | 1.49 | 0.40 | 1.755           | 5.427 | <0.001*|
|         | After bleaching | 1.18 | 0.37 | 2.063           | 9.198 | <0.001*|
| Group III| Day 7         | 3.32 | 0.85|                 |       |         |
|         | After re-polishing | 1.69 | 0.43 | 1.631           | 6.089 | <0.001*|
|         | After bleaching | 1.54 | 0.32 | 1.777           | 7.716 | <0.001*|
| Group IV| Day 7         | 3.55 | 1.81|                 |       |         |
|         | After re-polishing | 1.94 | 0.47 | 1.611           | 3.255 | 0.006*|
|         | After bleaching | 1.83 | 0.51 | 1.717           | 3.811 | 0.002*|
| Group V | Day 7         | 1.36 | 0.43|                 |       |         |
|         | After re-polishing | 0.83 | 0.33 | 0.527           | 3.927 | 0.002*|
|         | After bleaching | 0.78 | 0.31 | 0.579           | 4.053 | 0.001*|
| Group VI| Day 7         | 1.01 | 0.64|                 |       |         |
|         | After re-polishing | 0.73 | 0.34 | 0.282           | 1.562 | 0.141*|
|         | After bleaching | 0.68 | 0.28 | 0.334           | 1.663 | 0.119*

*Denotes significant difference
using Commission Internationale de l’Eclairage (CIE) L*a*b* colour system which is well suited for the determination of small colour differences. This system is related to the colour perception of the human eye for three coordinates for lightness, namely white-black(L*), red-green (a*), and yellow-blue (b*). The human eye can usually not detect ΔE* values of < 1.5, although this value is measurable using a colour spectrophotometer. A ΔE* value of 3.7 or less is considered to be clinically acceptable according to Johnston and Kao. Staining effects caused by coffee, tea, and Coca Cola were measured and expressed in ΔE* units, with the lower values indicating less staining. After immersion, staining was observed in all the specimens. The susceptibility of resin-based materials to staining may be related to resin content, filler type, filler matrix, or type of the staining agent. The higher the resin content of a material, the less is its resistance to photolytic, photo-oxidation and water sorption, thus rendering it more susceptible to staining. On the other hand, higher monomer conversion indicates a reduced amount of unreacted monomer, lower solubility, and higher colour stability. The Amelogen Plus microhybrid composite used in the present study is a Bis-GMA material which is about 76% filled by weight with a maximum particle size of 0.7 μm. Therefore, the staining susceptibility of this composite could be attributed primarily to the degree of conversion and the related water sorption values.

All the specimens immersed in the staining solutions, except those exposed to water, showed colour differences which were perceptible. Specimens immersed in coffee with sugar solution showed maximum colour change, followed by coffee solution, tea with sugar solution, tea and Coca-Cola. The staining ability of tea could be due to the presence of tannic acid. Discolouration by tea might be due to absorption of polar colourants into the material surface and the higher discolouration by coffee might be due to both adsorption and absorption of colourants. This absorption and penetration of colourants into the organic phase of the material were probably due to compatibility of the polymer phase with the yellow colourants of coffee. Cola drink does not appear to be strongly implicated in colour change of composites, despite the presence of phosphoric acid. Acids behave differently in promoting dissolution and hence in eroding the materials. In addition, the presence of phosphate ions in Coca-Cola may suppress the dissolution since these ions have been shown to reduce the dissolution rate of calcium phosphate from the tooth. When composite resins were immersed in water, the colour differences were imperceptible and clinically acceptable. This observation confirms that water sorption by itself did not alter the colour of composites to any extent. As immersion times increased, colour changes with the other media became more intense. The results were in agreement with those reported by, Yannikakis and colleagues, Chan and colleagues, and Fay and colleagues, all cited by Turkun. The reduction in mean ΔE values produced by the bleaching procedure could be attributed to the formation of very reactive per-hydroxy free radicals which may break up large macromolecular chains into smaller stain molecules. But this chemical process is also believed to accelerate the hydrolytic degradation of composites, contributing to wear of the resin in both stress-bearing and non-stress-bearing areas.

The limitation of the current study was that the storage conditions of the specimens does not mimc true oral conditions and the effect of bleaching on the structural integrity of the composite has to be studied to ascertain the long term durability of the composite restorations.

CONCLUSION

From the results of this study, it is concluded that:

- Among the staining solutions used in the current study, coffee with sugar showed maximum staining of composite resin specimens, followed by coffee tea with sugar and tea solutions respectively. Coca-Cola and water resulted in the least staining. The presence of sugar in coffee and tea solutions increases the staining capacity.

- Most of the staining observed on resin composites is superficial and can be removed partially by re-polishing or bleaching procedures.

Acknowledgement

We are grateful to Mr. Satish, Director, Bodhi Professionals Pvt Ltd, Bangalore and his team, for giving us co-operation and helping with the use of the colourimeter.

References


Contamination and disinfection of silicone pacifiers: an in vitro study

ABSTRACT

Introduction: Whilst in use as comforting devices, the nipples of pacifiers are permanently in contact with normal oral flora and saliva, allowing flourishing bacterial biofilms. Effective disinfection will limit contamination, promote oral health and prevent oral infections in children. Studies on pacifier disinfection in South Africa are not well documented.

Aim: To investigate in vitro disinfection of contaminated pacifiers with alcohol-free oral rinse and microwave.

Methods: Seventy two silicone pacifiers were divided into two groups of 36, and contaminated with standardized suspensions of *Candida albicans* and *Streptococcus mutans* respectively. Each group was subdivided into three and disinfected with alcohol-free oral rinse, microwave and sterile distilled water (control), followed by microbiological analysis. Data was analyzed using Kruskal Wallis Anova test.

Results: Alcohol-free oral rinse removed *S. mutans* from 42% of pacifiers, whilst microwave removed 33%. Microwave removed *C. albicans* from 83% of pacifiers, but alcohol-free oral rinse removed only 33%, a difference significant at p<0.05. All pacifiers treated with sterile water retained bacterial contamination.

Conclusion: Microwave was more effective than alcohol-free oral rinse in eliminating *C. albicans* from pacifiers. Microwave and alcohol-free oral rinse were equally effective in eliminating *S. mutans* from pacifiers.

Key words: *Candida albicans*, disinfection, microwave, oral rinse, pacifier.

INTRODUCTION

Pacifiers are commonly used as comforting devices during early childhood. During use, pacifier nipples are permanently in contact with oral normal flora and saliva, allowing flourishing of bacterial biofilms. These biofilms are important in the formation of plaque, which may lead to dental caries and periodontal disease in children. Several studies have shown that used pacifiers have the ability to retain microorganisms. The use of pacifiers has been associated with otitis media, infection by intestinal parasites and yeasts. There is also evidence that these microorganisms can interact with the immune system, leading to allergies, asthma and autoimmune diseases.

However, pacifiers do have their advantages, including soothing infants and affording protection against Sudden Infant Death Syndrome. A recent study showed that microorganisms transferred from mothers sucking pacifiers can reduce the risk of children developing allergies.

Very few studies have investigated disinfection methods for pacifiers. Nelson et al. and Chamele et al. investigated the effectiveness of alcohol-containing Colgate® PerioGard® Rinse and microwave in removing *S. mutans* from silicone pacifiers. In both studies, Periogard was found to be as effective as microwave irradiation in eliminating *S. mutans* from pacifiers. Da Silva et al. showed that microwave was the most effective method when compared with boiling in disinfecting pacifiers.

*S. mutans* is a major cause of dental caries, and is one of the bacteria causing infectious endocarditis in children with congenital heart disease. Early childhood caries (ECC) is one of the most common chronic childhood diseases affecting normal health and well-being. Whilst the overall prevalence of dental caries has reduced worldwide, that of ECC remains high and is a WHO concern.

In a study investigating the presence of *S. mutans* on latex and silicone pacifiers after use, the bacterium was found to predominate on the silicone pacifiers.

*C. albicans* is a fungus that causes oral thrush in infants and toddlers, and has been reported as a contaminant on pacifiers. In a study of infants up to 8 months of age, the use of a pacifier was found to be highly associated with the frequency of yeast infection, and *C. albicans* was one of the most prevalent species found. Comina et al. investigated the microbial contamination of used silicone and latex pacifiers. Eighty percent were found to be predominantly contaminated with *Staphylococcus* and *Candida* species.
Although there is evidence showing that used pacifiers can retain oral microorganisms\(^1,^2,^5\) there has been inadequate emphasis worldwide on disinfection methods and their effectiveness in limiting pacifier contamination, including in South Africa. There is therefore a need to investigate disinfection methods for pacifiers to limit their contamination and to promote oral health and prevent oral infections in children. None of the previous studies have tested the efficacy of alcohol-free GUM\textsuperscript{®} Paroex\textsuperscript{™} Chlorhexidine Gluconate oral rinse in disinfection of pacifiers. The rinse is used to inhibit build-up of plaque thereby reducing gingivitis.

The purpose of the current study was to investigate the in vitro disinfection of deliberately contaminated silicone pacifiers using the two methods of alcohol-free GUM\textsuperscript{®} Paroex\textsuperscript{™} Chlorhexidine Gluconate oral rinse and of microwave.

**Significance of study**
The knowledge gained from this study would inform the South African community of the importance of regularly disinfecting pacifiers, thus preventing infections such as early childhood caries and oral candidiasis.

**MATERIALS AND METHODS**

**Study population and methodology**
The study was conducted at the University of the Witwatersrand, Johannesburg, South Africa. Permission was granted to conduct the study by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg (W-CJ-130916-2). Seventy two new silicone pacifiers obtained directly from their packages (Golden Baby, CKT Tek Co. Ltd, New Taipei, Taiwan) were included in the study. Thirty six of these pacifiers were soaked in a standardised inoculum of C. albicans (ATCC 90028) at 150x10\(^6\) cfu/ml for 5 minutes. The remaining 36 pacifiers were soaked in a standardised inoculum of S. mutans (NCTC 1044) at 150x10\(^6\) cfu/ml for 5 minutes. The contaminated pacifiers were randomly divided into three groups of 12 each. Group 1 was sprayed three times with GUM\textsuperscript{®} Paroex\textsuperscript{™} Chlorhexidine Gluconate Oral Rinse (Sunstar Americas, Inc, Ontario, Canada), group 2 was placed in the microwave oven (Sharp SA, Midrand, South Africa) at 750 watts for seven minutes and Group 3 was sprayed three times with sterile distilled water. After disinfection, Group 2 samples were allowed to cool, and Group 1 was rinsed with sterile distilled water for two seconds to remove excess oral rinse.

**Microbiological evaluation**
After disinfection, all the pacifiers were aseptically suspended in 20ml of sterile phosphate buffered saline (PBS) for two minutes and vortexed for microbial cell detachment. From the initial suspension, dilutions of 10\(^{-1}\), 10\(^{-2}\) and 10\(^{-3}\) were prepared in sterile PBS, and 0.1 ml of each dilution was plated on Mitis salivarius Bacitracin agar (MBA) for the recovery of S. mutans and Sabouraud Dextrose agar (SDA) agar for the recovery of C. albicans. The SDA plates were incubated at 37°C for 48 hours, and the MBA plates at 37°C (5% CO\(_2\)) for 48 hours. On conclusion, the numbers of colonies in each plate representing live organisms were counted.

**Data analysis**
Data were analysed using Kruskal-Wallis ANOVA. Statistical significance was set at the 5% significance level.

**RESULTS**
Alcohol-free oral rinse removed S. mutans from 42% of pacifiers, as compared with microwave which removed S. mutans from 33% of pacifiers. Microwave removed C. albicans from 83% of pacifiers, as compared with alcohol-free oral rinse, which removed 33%. Sterile water failed to remove either S. mutans or C. albicans colonies from any of the pacifiers (Figure 1).

Alcohol-free oral rinse and microwave were statistically similar in eliminating S. mutans (p>0.05). There was a statistically significant difference between alcohol-free oral

### Table 1: Statistical assessment of colony forming units for each microorganism after disinfection with the different methods (Kruskal-Wallis ANOVA)

<table>
<thead>
<tr>
<th>Organism tested</th>
<th>Method</th>
<th>N</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Min</th>
<th>Max</th>
<th>P value</th>
<th>Statistically significant differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candida albicans</td>
<td>Sterile distilled water</td>
<td>12</td>
<td>256250.0</td>
<td>25434.85</td>
<td>200000.0</td>
<td>287000.0</td>
<td>0.0001</td>
<td>Sterile distilled water</td>
</tr>
<tr>
<td></td>
<td>Alcohol-free Oral rinse</td>
<td>12</td>
<td>1833.3</td>
<td>2289.63</td>
<td>0.0</td>
<td>7000.0</td>
<td>Alcohol-free Oral rinse Microwave</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Microwave</td>
<td>12</td>
<td>3166.7</td>
<td>7505.55</td>
<td>0.0</td>
<td>22000.0</td>
<td>Alcohol-free Oral rinse Microwave</td>
<td></td>
</tr>
<tr>
<td>Streptococcus mutans</td>
<td>Sterile distilled water</td>
<td>12</td>
<td>250000.0</td>
<td>28556.16</td>
<td>200000.0</td>
<td>287000.0</td>
<td>p&gt;0.05</td>
<td>Alcohol-free Oral rinse Microwave</td>
</tr>
<tr>
<td></td>
<td>Alcohol-free Oral rinse</td>
<td>12</td>
<td>1666.7</td>
<td>1874.84</td>
<td>0.0</td>
<td>5000.0</td>
<td>Alcohol-free Oral rinse Microwave</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Microwave</td>
<td>12</td>
<td>183333</td>
<td>2289.63</td>
<td>0.0</td>
<td>7000.0</td>
<td>Alcohol-free Oral rinse Microwave</td>
<td></td>
</tr>
</tbody>
</table>

![Figure 1: Proportion of pacifiers without contamination after disinfection procedures.](image)
rinse and microwave in eliminating C. albicans (p<0.05). Statistically significant differences were observed in sterilising efficacy between microwave, alcohol-free oral rinse and sterile water for the removal of both C. albicans and S. mutans (p=0.001). (Table 1)

**DISCUSSION**

Bacterial biofilms flourish during the continuous contact of pacifier nipples with saliva and oral microorganisms. Disinfection methods for pacifiers have not been adequately addressed. The findings of the current study confirm previous reports that pacifiers can be contaminated by S. mutans. There is a need to investigate effective and easy disinfection methods for pacifiers to reduce microbial contamination.

In the current study, alcohol-free oral rinse removed S. mutans from 42% of pacifiers, as compared with microwave which showed a success rate of 33% (not significant at p>0.05). This finding differs from those of previous studies, in which it was shown that Periogard containing an alcohol rinse, and microwave irradiation both eliminated S. mutans from 100% of pacifiers. The presence of alcohol in the Periogard may have increased the disinfecting effect, as alcohol is a known antiseptic. In contrast, a study that investigated the use of mouth rinses with or without alcohol to reduce plaque found both to have similar effects.

In a previous study, S. mutans has been shown to predominate in silicone pacifiers, and microwave removed this organism from 100% of the pacifiers.

This study revealed that microwave was more effective (83%) than alcohol-free oral rinse (33%) in eliminating C. albicans from silicone pacifiers, showing a statistically significant difference (p<0.05) between the disinfecting methods. Da Silva et al. found microwave to be as effective as boiling water in disinfecting both latex and silicone pacifiers contaminated with C. albicans. Microwave can thus be used for disinfecting silicone pacifiers, as these pacifiers were previously reported to be heat resistant. Microwave has also been found to be effective in the disinfection of other dental materials such as prostheses, acrylic resins and orthodontic instruments.

S. mutans and C. albicans colonies remained present in all (100%) pacifiers treated with sterile water, confirming that the use of water to clean pacifiers is not effective in eliminating contamination. Chamele et al. demonstrated that S. mutans colonies were still present in 75% of pacifiers treated with sterile water.

_Candida_ was found by Comina et al. to be one of the most predominant species found in used pacifiers collected from day-care centers. Da Silva et al. reported boiling water to be as effective as microwave in removing C. albicans from pacifiers.

The limitation of the current study is that it was in vitro, carried out on new pacifiers. Different results may be evident if used, worn out pacifiers are assessed in a similar study, for older pacifiers might provide an even more suitable environment for the attachment of microorganisms.

**CONCLUSIONS**

Based on the sample size and parameters of this study:
1. Silicone pacifiers can be contaminated in vitro with S. mutans and C. albicans.
2. Microwave was more effective than alcohol-free oral rinse in eliminating C. albicans from silicone pacifiers.
3. Microwave and alcohol-free oral rinse were equally effective in eliminating S. mutans from silicone pacifiers.

Conflict of interest: None declared

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Ocular complications with dental local anaesthesia – a systematic review of literature and case report

ABSTRACT
Introduction: Intraoral local anaesthetics are commonly administered in Dentistry and may be associated with complications. Although ocular complications are rare they may occur with both maxillary and mandibular injections.

Materials and methods: A database search was carried out in Pubmed and Ovid MEDLINE using the keywords: ocular/ophthalmic/visual, dental anaesthesia/local anaesthesia and complications/paralysis. Each case report was analyzed for age and sex of the patient, type of anaesthesia given, the anaesthetic and vasoconstrictor used, quantity given, onset and duration of complications, and type of complications. 140 case reports were included. The data were recorded on a data extraction form and statistically analyzed.

Conclusion: Complications occurred more frequently in females, and in the age range 20-40 years old. The type of complication was specific to the technique used. Although rare, such complications are distressing and the clinician must be alert to the possibility in order to minimize occurrences and to be able to reassure patients.

Keywords: dental anaesthesia, ocular complications, diplopia, amaurosis

INTRODUCTION
The delivery of local anaesthetics is one of the most widespread procedures in dentistry and is vital to achieving pain control and cooperation in the dental patient. Although it is usually a safe procedure, several complications have been associated with its use. These complications can either be localized, such as trismus and infection, or systemic, such as anaphylaxis and reactions to overdose. Ophthalmic complications are relatively rare and account for 0.04 to 0.1% of all complications.1,2 The most common complications include diplopia, amaurosis, ophthalmoplegia, ptosis and mydriasis.3 These are mostly transient. Permanent complications are exceedingly rare and very few cases have been reported in the literature. Nevertheless, it is essential that the dentist be aware of such complications in order to diagnose and manage them effectively, and where applicable, to refer them without delay.

The purpose of this study was to review the literature reporting on ocular complications associated with dental local anaesthesia and to analyze whether such complications were related to a specific common variable such as technique or drug used. A case report is also presented.

MATERIALS AND METHODS
An electronic database search was carried out in Pubmed and Ovid MEDLINE. The combinations of keywords used included: ocular/ophthalmic/visual, dental anaesthesia/local anaesthesia and complications/paralysis. A manual search was also carried out using the reference lists of selected articles. Abstracts of all the selected articles were screened and only those articles which specifically described cases of ocular alterations following dental anaesthesia were chosen. Reviews of literature were excluded. Each case report was analyzed for the following parameters: age and sex of the patient, type of anaesthesia given, the anaesthetic and vasoconstrictor used, quantity given, onset and duration of complications, and types of complications that occurred. Details of needle gauge, length and aspiration done prior to procedure were also noted if mentioned in the case report. All details were recorded on a data extraction form for statistical analysis.
RESULTS

From 1936 to 2014, a total of 140 cases have been reported in the literature, including the one presented in this report. Ocular complications were more frequent in females (63.5%) as compared with males (36.4%). The age of the patients ranged from 4 years to 73 years (mean 38.5 years), the majority being between 20 and 40 years of age (56.4%).

Although several techniques have been associated with ocular complications, the commonest technique was the inferior alveolar nerve block (54.2%), followed by the posterior superior alveolar nerve block (30%). The commonest anaesthetic drug used was lignocaine (68%), followed by articaine (18.5%). Few cases utilized mepivacaine (5%), procaine (5.8%), prilocaine (1.6%) and butethamine (0.8%). 90.7% of these agents contained a vasoconstrictor. The commonest vasoconstrictor was epinephrine in a dilution of 1:100000 (64.7%).

The frequency of ocular complications is given in Figure 1. It was noted that most symptoms were technique-specific. Symptoms more specific to maxillary techniques included diplopia (74.7%), lateral rectus palsy (81.8%), mydriasis (73.3%) and ptosis (76.6%). Amaurosis was more common in mandibular blocks (84.6%), as were blanching (90%) and blurred vision (72.7%). These results are in accordance with findings reported in previous literature reviews. 2-4 It was noted that all cases that reported blanching had used epinephrine as a vasoconstrictor.

Only half the cases reported mentioned onset of action. Most of these had immediate onset of action (20.9%) or within a few seconds (8%) or minutes (41.9%). Only 3% had late onset of more than 24 hrs. There was no correlation between anaesthetic technique and onset of action.

In more than half the cases, symptoms resolved within 30 minutes (57.1%). Even in cases where anaesthetics with longer duration of action were used, symptoms resolved within 120 minutes. In 71% of patients, symptoms lasted for few days to weeks. 5.5% of patients had permanent symptoms. There was no correlation between technique used or quantity of anaesthetic used and duration of symptoms.

CURRENT CASE REPORT

The present case involved a 30 year old healthy woman who reported to our hospital for routine extraction of the left mandibular third molar. Local anaesthetic was administered by a postgraduate student, using 2% lignocaine with 1:80000 adrenaline. Aspiration was negative and the student proceeded to inject the local anaesthetic solution. Less than 0.5ml of the solution had been injected when the patient suddenly complained of loss of vision and inability to open the eye. The eyelid was propped open with a finger, following which it was noticed that the eyeball had become completely fixed. After five minutes, the patient could keep the eye open without assistance and eye movements returned to normal in all planes except for adduction, which returned to normal in 30 minutes. No blanching of the skin or loss of accommodation was noted. As the patient was apprehensive, it was decided not to proceed with the extraction. The patient was discharged after observation for one hour. Follow-up after two days revealed no further complications. The procedure was then carried out uneventfully.

DISCUSSION

Ocular complications following local anaesthesia are uncommon and the frequency is estimated to be 1 in 1000.3 They can, however, cause considerable anxiety to both the patient and the clinician. From the patient's point of view, this is a totally unexpected event and may be extremely alarming. The clinician, if not acquainted with the nature of these complications, may fail to diagnose such an incident,5 and may even attribute it to a more serious event, like a transient ischemic attack.6 It is therefore essential that the clinician understand the etiology and pathogenic mechanism of these complications.

There has been no agreement on the exact pathway that leads to these manifestations. The following theories are currently accepted:

Intra-arterial route:
Intravascular injection appears to be the main cause for these manifestations following mandibular nerve blocks. The inferior alveolar artery and vein lie in close proximity to the nerve within the inferior alveolar canal. Even if the initial aspiration is negative, as was mentioned in twelve cases of inferior alveolar nerve blocks, slight movement of the patient or operator could result in inadvertent injection into the artery. It is hypothesized that under pressure, the
local anaesthetic solution is forced back into the maxillary artery. It has also been reported that in 37% of the population, the maxillary artery loops downwards, lateral to the lingual and inferior alveolar nerves. Hence direct injection into the maxillary artery is also possible.7,8

The anaesthetic solution may pass from the maxillary artery into the middle meningeal artery or accessory middle meningeal artery. The middle meningeal artery is believed to anastomose with the ophthalmic artery, and in some cases the ophthalmic artery may even arise as a branch of the middle meningeal artery.9,10

**Amaurosis**

The central artery of the retina arises from the ophthalmic artery. If the local anaesthetic passes into this vessel, it may result in transient amaurosis. In seven case reports, amaurosis was permanent. The mechanism behind permanent amaurosis is unclear. It has been suggested that reflex vasospasm of the central retinal artery could result in ischaemia and necrosis of the retinal tissue, causing permanent amaurosis. It was also suggested that oil embolism could have occurred following intravascular injection of fat-based local anaesthetics. While the anaesthetic used is not mentioned in five cases, two report the use of procaine hydrochloride.11,12

The choroidal vessels that supply the retinal cones also appear to be the most frequently paralyzed muscle.

The accessory meningeal artery has terminal branches within the cavernous sinus. The III, IV and VI cranial nerves are all located within the sinus and may become anaesthetized by the anaesthetic being carried into the cavernous sinus. This could be responsible for palsy of the other extraocular muscles. Palsy of the third nerve would also lead to mydriasis, ptosis and loss of accommodation.

**Diplopia and extraocular muscle palsy:**

The ophthalmic branch of the middle meningeal artery may anastomose with the lacrimal artery that supplies the lateral rectus muscle. The anaesthetic may, therefore, reach the lateral rectus muscle, paralyzing it. It was noted that lateral rectus appeared to be the most frequently paralyzed muscle.

The choroidal vessels that supply the retinal cones also derive their blood supply from the ophthalmic artery. If these vessels were affected, it could affect the colour vision. The ‘purple haze’ described by Scott et al may have been precipitated by this mechanism.14

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**Local diffusion:**

This is the probable mechanism for ocular manifestations following maxillary nerve blocks. Over-insertion of the needle during a posterior superior alveolar nerve block could result in direct diffusion of the anaesthetic solution from the pterygopalatine fossa to the orbit via the inferior orbital fissure. The abducent nerve lies nearest to the fissure and hence the most commonly affected muscle is the lateral rectus, which accounted for 66.6% of all palsies.13 It was noted that in 60% of posterior superior alveolar blocks given (18/30 cases), articaine was used, which is believed to have superior diffusion properties. The use of longer needles and increased depth of insertion may also be a factor. While most cases do not mention the depth of insertion, Kini et al have stated that they used a 1.5 inch needle (38mm).17

In the case of greater palatine nerve blocks, and maxillary blocks through the greater palatine canal, it must be noted that the greater palatine canal opens to the inferior surface of the pterygopalatine fossa and solution may diffuse from here to the orbit.

**Intravenous injection**

It has been suggested that inadvertent intravenous injections could reach the cavernous sinus via the pterygoid plexus and anesthetize cranial nerves III, IV and VI as described earlier. The posterior superior alveolar nerve block is most likely to cause this, as even a minor change in position and depth of the needle could pierce the pterygoid plexus.19,20

**Autonomic dysregulation**

Several cases of ocular complications occur despite negative aspiration. Kronman et al suggested an alternate hypothesis.21 Each artery is surrounded by a delicate sympathetic plexus. Trauma to either the inferior alveolar or posterior superior alveolar arterial wall could occur by the anaesthetic needle scraping against it. This sets up an impulse that travels through the plexus on the maxillary artery, via the deep petrosal nerve and internal carotid plexus to the ophthalmic artery. This hypothesis is supported by the phenomenon of blanching in some cases.22 Campbell et al theorized that in their case, thestellate ganglion could have been accidentally blocked by diffusion through the fascial planes.23 This mechanism could account for manifestations of miosis and enophthalmos seen in certain cases.24

Most authors agree that the likeliest mechanism is the intravascular route. There are, therefore, several ways in which such complications can be prevented. It is advisable to use self-aspirating syringes. In case non-aspirating syringes are used, double plane aspiration must be performed, and subsequent movement of the patient and operator must be avoided. The anaesthetic solution must be injected slowly, giving a full cartridge over a period of 60 seconds. This would avoid injecting the solution under pressure. Anatomical landmarks must always be visualized prior to injection, especially in paediatric cases, where the mandibular foramen would be at a higher level.

The gauge of needle used for injection may play an important role in these complications. Firstly, smaller gauge needles are more likely to be deflected as they pass through tissues; secondly, a few studies have shown that aspiration of blood is more reliable through a larger lumen. Thirdly, it is likely that the anaesthetic may be injected under greater pressure when the lumen is smaller, hence chances of backflow are greater. Malamed stated that the 25-gauge needle is preferred for all injections where the risk of positive aspiration is high. Although only 32 cases in this review have mentioned the needle gauge, 41% of these (13 cases) have used needle sizes narrower than 25-gauge. It is also important to control the depth of insertion as over-insertion would increase the risk of penetrating a vessel and also increase the risk of the anaesthetic spreading by local diffusion.

Once an ocular complication has occurred, the guidelines recommended by Lee, Van der Bijl and Boynes may be followed.4,26,27 The first and most important step is to reassure the patient. The affected eye may be covered with gauze till the symptoms subside, and the patient must be escorted home, as monocular vision prevents the patient from judging distances. If the symptoms persist for longer than six hours, consultation with an ophthalmologist is mandatory. In most of the cases, clinicians have proceeded with the dental procedure despite the ocular symptoms. There is no harm in performing the procedure, however, if the patient is anxious, it may be desirable to postpone the procedure to the next visit.
Conflict of interest: None declared

References
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Squamous Cell Carcinoma of the upper lip in an 8 year old child – a case report

ABSTRACT
Squamous cell carcinoma (SCC) frequently occurs between the 5th and 7th decades of life. Its occurrence in adolescence is uncommon, and it is less common in children.1-4 South Africa has a kaleidoscope of social and ethnic belief systems which may influence the management of these patients. This case report presents a rare occurrence of a squamous cell carcinoma involving the upper lip in an eight-year-old child.

INTRODUCTION
Cancer of the lip may originate from the labial mucosa, the epithelium of the vermilion border of the lip, or from the accessory glands present at the vermilion-cutaneous and the vermilion-oral mucosal junctions respectively.5,6 Squamous cell carcinoma is the most common malignancy of the lip, but it rarely occurs in subjects under 20 years of age.1 The aetiological and predisposing factors of lip cancer include, excessive exposure to sunlight, tobacco usage, viral infections, racial factors, a genetic predisposition, immunosuppression, immunodeficiency, certain occupations and familial factors.5,6 We present an unusual case of an eight-year-old black female patient with a SCC of the left side of the upper lip.

CASE REPORT
An eight year old black female patient attended the Maxillofacial and Oral Surgery department of Grey’s Hospital, Pietermaritzburg, KwaZulu-Natal, South Africa with a non-healing ulcer of the upper lip of seven months duration. There was no significant medical history. The lesion had started as a small ulcer which appeared spontaneously, and gradually increased to a size of approximately 10x15mm, with a central area of crusting (Figure 1). There were no palpable regional lymph nodes. A differential diagnosis of tuberculous (TB) ulcer, traumatic ulcer, syphilitic ulcer, human papilloma virus (HPV) related ulcer and pseudoepitheliomatous hyperplasia was made. A biopsy of the lesion was performed under general anaesthesia.

HISTOLOGY REPORT
Histology showed extensive ulceration and the presence of an infiltrating tumour involving the subepithelial connective tissue and superficial orbicularis oris muscle. In the muscle, a focus of perineural invasion was observed. In one small focus, there was residual dysplastic squamous epithelium from which the tumour appeared to arise. The tumour was comprised of small dysplastic squamous cells staining positively with immunohistochemical stains CK5/6, P63 and P16. The overall histomorphological appearances and immunohistochemical staining characteristics were indicative of a moderate to poorly differentiated non-keratinising squamous cell carcinoma (Figure 2a and b). Polymerase chain reaction (PCR) for HPV infection was negative, though the expression of P16 by oropharyngeal squamous cell carcinomas is often indicative of HPV infection. However, Larque et al reported that the correlation is not absolute with 80% of such lesions testing negative for HPV by PCR,7 as was the case in this instance.

PLANNED TREATMENT
The patient was discussed with the Department of Plastic and Reconstructive surgery. An urgent surgical excision of the lesion was suggested. The patient and her mother were referred for pre-surgical counselling. During counselling, the mother expressed her family’s cultural beliefs and stated that the child’s father believed that the lesion had arisen because the spirits of their ancestors were displeased with something. He therefore believed that intervention by a traditional healer was the method of choice in the management of this malady. The mother on the other hand, expressed concern about her child not receiving surgical treatment. The father remained adamant about his beliefs. The patient subsequently failed to arrive for treatment and was lost to follow-up.
**DISCUSSION**

Squamous cell carcinoma is the most common head and neck neoplasm in the adult population above 60 years of age but is uncommon in adolescents and in children.\(^6\) Cancer of the lip may originate from either the labial mucosa, the epithelium of the vermillion border, or rarely (adenocarcinoma) from the sebaceous or minor salivary glands present at the vermilion-cutaneous or the vermilion-oral mucosal junctions respectively.\(^5,6\) Repeated exposure to ultraviolet light B (UVB, wavelength 290 – 320nm) causes lower lip actinic cheilitis. Ultraviolet light irradiates the deoxyribonucleic acid (DNA) within the nuclei of the non-keratinising epithelial cells of the vermilion border, inducing alterations in the p53 tumour suppressor gene,\(^6\) which is important in regulating cell division. Alterations in this gene renders it ineffective in limiting the proliferation of cells with altered DNA, thus promoting neoplasia.\(^6\)

Tobacco usage has long been established as a causative agent for cancer of the lip and tongue with the most important carcinogen being nitrosamines.\(^6\) Conflicting reports have been published as to whether there is a direct link between lip cancer and tobacco use. However, it is believed that there is a synergistic effect between sunlight induced actinic cheilitis and tobacco usage, with sunlight reducing the permeability of the more superficial epithelial cells of the vermilion border, thus exposing the deeper cells to the carcinogens in tobacco.\(^4,6\) Viral infections may be a contributing factor in oral squamous cell carcinoma.\(^6\) Herpes simplex virus (HSV1) has the potential to transform cells in vitro. The potential for transformed cells to become malignant is increased by tobacco usage. The Human Papilloma Virus, most notably HPV-16 has been associated with oral SCC.\(^5\) Persons with light hair, eyes and skin are at a significantly higher risk of sunlight-related squamous cell carcinoma in general, and of the lip in particular. Lip cancer is 30 times more common in white men than in black men.\(^6\) The difference can be accounted for by the shielding effect of the pigment melanin.\(^6,10\) Cancers have been reported to arise in immunosuppressed patients, particularly those who have received organ transplants. The development of lip cancer in renal transplant patients who are on immunosuppressants has been reported.\(^6\) Although acquired immune deficiency syndrome (AIDS)
patients are known to be susceptible to oral neoplasia, by 1998 only three AIDS patients with lower lip cancer had been reported. Stolk-Liefferink reported 65 cases of oral SCC in children, 22 cases in males and 15 in females, while the genders of 28 patients were unreported. The ages ranged from 2 to 20 years. In six of the 65 cases, SCC occurred on the lip, while 26 occurred on the tongue, four on the gingiva, one on the cheek and 28 sites were unreported. An increasing incidence of oral SCC in the younger population has been reported in several countries. Recent studies have reported it to occur with a frequency of approximately 4% of all oral neoplasms in patients younger than 40 years of age. Few cases of oral SCC occur in patients younger than 18 years. The incidence is lowest in the first decade of life. Using the tumour, node and metastasis (TNM) staging of head and neck cancers, Salihu et al reported that the 10 year survival rates for stages I, II, III and IV for lower lip cancers are 91.7%, 83.7%, 28% and 11.4% respectively. They emphasised that early intervention is essential in order to achieve favourable survival rates.

CONCLUSION
To the best of our knowledge this is the first case of a Squamous cell carcinoma of the upper lip, being reported in an eight-year-old child. Squamous cell carcinoma caused by HPV from sexual abuse was suspected in this case. The child was subsequently referred for counselling. The father of the child believed that their ancestral spirits were displeased for some reason. This has resulted in punishment being inflicted on the child in the form of an illness. This illness, he believed, could be managed with the help of a traditional healer. A belief in traditional medicine and traditional healers is common in South Africa, and is therefore likely to persist for a long time in the future. The co-existence of traditional medicine and belief systems in the 21st century can result in the delay of patients seeking medical or surgical intervention timeously. It is therefore necessary that the plight of such patients be brought to the attention of the law makers, the health professionals and the public at large. Failure to give this matter the seriousness that it deserves, could result in adverse outcomes.

Conflict of interest: None declared

References
This patient presented with a sunken concave midface, anterior open bite, vertically elongated head, wide spread bulging eyes, various impacted teeth and chronic pain on the left side of the face. She also has syndactyly of the hands and feet. The same condition is also present in several members of her family. What is your diagnosis?

**INTERPRETATION**

A diagnosis of Apert syndrome was made. Apert syndrome is a rare developmental condition characterized by premature cranial synostosis and resultant growth disturbances. Signs of Apert syndrome include a peaked and vertically elongated head, widespread bulging eyes, and a protuberant frontal region with an anteroposterior ridge overhanging the frontal eminence (Figure A). The palate is high, arched and occasionally cleft (Figure B). There is hypoplasia of the maxilla with relative prognatism of the mandible. Dental malocclusions with crowding and delayed dental eruption in the maxilla are common (Figure C). The facial angle is exaggerated; the nose is small and has been compared to a parrot’s beak in appearance. Hypertelorism, exophthalmos and divergent strabismus are often present; sometimes with blindness. Spina bifida has been recorded in some patients. Syndactyly of the hands and feet varies greatly. Hand films in Apert syndrome showing syndactyly with fusion of three fingers in both hands and webbing (Figure D). Syndactyly of the feet in the same patient is also discernible (Figure E). Note the tall (turricephalic) skull, open metopic suture, and faint beaten-silver appearance of the calvarium. Skull base and roof of the calvarium are flattened, with a noticeable beaten-silver appearance (Figure F). The 3-D CT reconstruction of the same patient showing hypoplastic maxilla with posterior cleft (Figure G). The patient may be retarded or of normal intelligence. Apert syndrome may be associated with advanced paternal age. The cardinal radiologic features of Apert syndrome are: Brachycephalic (reduced anteroposterior dimension of the skull with increased skull width). Turricephaly (occurrence of a skull with high vertical index), beaten silver appearance of the calvarium, absence of demonstrable cranial sutures in coronal dimension in young patients, hypoplastic maxilla and syndactyly of the hands and feet. Differential Diagnosis: Crouzon’s disease, Pfeifer syndrome, Carpenter syndrome and Summit syndrome.

**Reference**

Dental professionals encounter a number of challenging ethical and legal dilemmas on a daily basis that often arise due to conflicts between the ethical principles of autonomy, non-maleficence (do no harm), beneficence (do good), justice, veracity, and fidelity. The application of ethical principles has always been important during any patient encounter, and previously a health professional’s obligation was focussed on doing good and avoiding harm rather than giving in to the patient’s requests. Today a patient-centred holistic approach and respect for patient autonomy is a more apparent in health care.

In the practice of dentistry, extractions are indicated for a variety of reasons. Third molar teeth are frequently extracted due to impaction, other teeth are extracted due to caries, periodontal disease, trauma, and for prosthetic and orthodontic reasons. As with all our treatment, the role of the dentist will be to inform the patient of the diagnosis, treatment options, risks and benefits, among other factors, and the patient will then weigh up the alternatives and has the option to agree to the treatment proposed. However, this is not always the case and patients may request the removal of teeth, despite the fact that there is no indication for that approach. In these situations, it is important to distinguish whether an irrational request is made by a patient with the capacity to consent and or by a patient without the capacity to consent. The patient’s request could be on account of fear, or a mental disorder such as post traumatic stress disorder, a somatoform pain disorder or a disorder of body image perception. Although patient’s aesthetic goals are important in treatment planning, a dentist has an ethical responsibility to educate them regarding realistic goals and appropriate treatment options. The dentist is then faced with the question of whether the patient is mentally competent to make the decision. In the case of a request for tooth removal made on a psychopathologic basis, a dentist has to refuse to carry out such treatment, but should make an effort to help or guide the patient to seek other care.

When assessing a request for extraction three concepts are critical – that of informed consent, ‘best interest’ and the standard of care. When obtaining informed consent for treatment, practitioners must consider both the legal competence and decision-making capacity of the patient. If decision-making is impaired, input should be solicited from others to arrive at treatment decisions in keeping with the patient’s values concerning dental care. When a patient is able to make his/her own decisions, respect for autonomy is dominant. However, where incompetent patients or young children are concerned, health professionals need to act in the best interests of patient. Respecting the patient’s irrational request for extractions (autonomy) conflicts with the principle that it is not in their best interest (beneficence). Patient autonomy in itself is not a rationale for treatment and does not give the patient the right to choose inappropriate treatment.

According to the National Health Act of No 61 of 2003, Chapter 2 Section 6 the following information must be given to the patient (User of Health Care Service):3:

- Range of diagnostic procedures and treatment options available
- Benefits, risks, costs and consequences associated with each option
- User’s right to refuse care, in which case the dentist should explain the implications, risks and obligations of such refusal
- Furthermore, this information must be provided in a language that the patient understands and in a manner that takes into account the patient’s literacy level.

Practitioners must work on the presumption that every adult has the capacity to decide on what treatment they want, unless it is shown that they cannot understand information which has been presented in a clear way. If a patient’s choice appears irrational, or does not accord with the practitioner’s view of what is in the patient’s best interests, this is not evidence in itself that the patient lacks competence. In such circumstances it may be appropriate to review with the patient whether all reasonable steps have been taken to identify and meet their information needs.

A competent patient is usually able to make a choice based on an understanding of the information given to him/her, an appreciation of the diagnosis, and procedure and its consequences, and will be able to reason and weigh up the proposed treatment options. There are a number of questions to consider when assessing the capacity of patients: Can the person understand the information being provided? Can the person assimilate the information?
Can the person make a decision? Some patients may also present with partial or temporary incapacity and issues like maturity, complexity of the diagnosis, illness, injury, alcohol and drug use may all have an impact on a person's ability to make decisions. A person who lacks full capacity may be able to make a rational decision with regard to simple treatment options, but not to more complex reasoning. Where patients have difficulty retaining information, or are only intermittently competent to make a decision, health care practitioners should provide any assistance which may be needed to ensure an informed decision is reached by the patient.

The health care worker is required to take all reasonable steps to obtain the user's informed consent. However, in situations where patients lack competence to consent, surrogate decision makers must be consulted to represent the 'best interests' of the patient. This principle is often applied in situations of special need and where people do not have capacity to take decisions for themselves. This premise then invites the question, 'Who determines what is in the best interest and what does one do when a conflict arises between various parties with an interest in the welfare of the patient?' Parents are usually regarded as acting in the best interests of their children. But where adults are concerned, practitioners may have an ethical dilemma in deciding what to do when an adult patient is incapable of making a decision for him/herself. What is in the best interests of the patient? Whose moral codes are used to determine this?

The National Health Act of No 61 of 2003, Chapter 2 Section 7 (Consent of User) makes provision for certain persons to consent on behalf of mentally incompetent patients to an operation or medical treatment where such patients are unable to give the necessary consent and have not mandated - while still mentally competent-somebody else in writing to give consent on their behalf. The Act sets out a priority list of persons who may consent in such circumstances:

1. A person authorized by the court (e.g. a curator); or
2. In order of priority, the patient’s spouse, partner, parent, grandparent, major child or brother or sister,
3. Health care practitioners should also consult the provisions of the Mental Health Care Act (Act No.17 of 2002) when dealing with mentally ill patients.

Apart from the legal requirements, the following issues should be taken into consideration when assessing what might be in the best interests of a patient. It may also be useful to determine who has an interest in the care of the patient and whether such people should be involved in discussions so as to respect the patient’s right to privacy and confidentiality. It is usually beneficial to share any ‘best interest’ decision with those responsible for the patient’s care.

- The patient’s values and preferences if they were known to have been competent at some time in the past
- The patient’s psychological and spiritual well-being
- The patient’s physical well-being
- The patient’s overall quality of life
- The relationship and impact of the patient’s condition on family and carers.

CONCLUDING REMARKS

In cases where the patient’s request for extractions is not based on rational considerations, the dentist’s advice and recommendation is also important. This is especially relevant in South Africa where the concept of autonomy is not fully developed and where patients still place high value on the advice of their dentists. In advising patients, it is essential that the dentist is always motivated by the patient’s best interests. Specific time needs to be set aside when eliciting informed consent and for complicated scenarios it may be necessary to provide written patient information. Competent patients can make ‘wrong’ decisions. Provided the condition is not life threatening and the patient is not ignorant and uninformed, an informed ‘wrong’ decision should be respected.

As a profession we have a duty to weigh up the benefits and risks of any procedure, and if the potential harm outweighs the benefits, even patients requests for treatment should be declined. The role of the dentist in educating such communities is crucial and a reflection of the principle of beneficence. When dentists are approached with irrational requests, they have an obligation to counsel and discourage unnecessary treatments, and in these situations paternalism is justifiable. Dentists must be aware of the ethical and dento-legal risks that accompany requests for irrational treatments and the solution is to counsel the patients, and inform them fully in the consent process.

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What’s new for the clinician? 
Summaries of and excerpts from recently published papers

1. Template-guided vs. non-guided drilling in site preparation of dental implants


Sufficient primary stability of the implant is a prerequisite for successful clinical success in osseointegration. A micro-movement of no more than between 50 and 150μm is acceptable.1 Osseointegrative processes are dependent on the width of the necrotic zone which needs to be kept to a minimum in site preparation. Critical mechanical aspects during site preparation are the geometry of drills, which directly affects the magnitude of drill temperature reached, the pressure applied to the bone and the speed and torque used.1 It is known that the bone is very susceptible to thermal injury and factors such as drill bit geometry, feed rate, shape of the drill flute, sharpness of cutting edges, the value of the point angle, and drill wear influence the amount of frictional heat production which can cause thermal injury to bone.1

Bone is a very challenging material to drill, due to its unique properties. Drill bits need to fulfil special requirements such as the ability to evacuate chips and debris from the drill flute, as the bone tends to clog.1 Clogging leads to significant increases in force and torque. Unguided free-handed manual handling drilling actions are influenced by individual strength, hand movement and technical skills. These characteristics may be able to balance or compensate for the problems of dull cutting tools and frictional heat and thus influence the result of drilling action on the bone but this may vary depending on the type of instruments used, the experience of the clinician and the quality of the bone.1 Thus, it is clear that the drilling of bone is a dynamic process, and is influenced by several factors.

Procedures involving the drilling of the bone are highly challenging due to vibration, inaccessibility of the surgical area and potential failure by inaccurate motion control or even drill bit breakage. In oral surgery and in dental implantation, guide templates are extensively used for the gradual expanding drilling sequences in the human jawbone.1

Scherer and colleagues (2015)1 reported on a study that sought to investigate the potential ability of template-guided drilling to aid in compensating for the inevitable irregularities of manual working procedures on the part of the handler. The researchers described drilling tests carried out using guidance templates as well as free-hand drilling procedures and compared the results of experienced against inexperienced handlers.

MATERIALS AND METHODS

The drilling experiments were carried out in a total of 24 fresh cadaveric porcine mandibles taken from three-year-old animals, which were divided into four groups. Mandibles in group 1 (n=6) underwent the free-handed drilling actions of persons without surgical knowledge and poor operating experience in mechanical drilling. Group 2 (n=6) consisted of the same operators, but this time performing drilling actions with the help of template guidance. Group 3 (n=6) saw free-handed drilling actions performed by highly experienced oral and maxillofacial surgeons. In group 4 (n=6), these professionals were performing drilling actions with support of template guidance. Each of these four experimental groups comprised three operators. Every jawbone underwent a total of five drilling actions of a single operator. Results were thus obtained for 15 drilling actions per operator, and a total of 180 drilling actions could be analysed.

Prior to each experiment, porcine mandibles were cleaned of adherent soft tissue. Specimens were separated in half by sawing, one section was placed on a drilling platform and the assembly securely clamped in a phantom head. An electric drilling instrument with continuous saline cooling was used. Drilling actions for preparation of monocortical implant anchorage were carried out according to the surgical protocol suggested by the drill manufacturer (Bego, Bremen, Germany). Template-guided drilling was provided using Plexiglas gauges with embedded guiding sleeves. Into these guiding sleeves, spoons with a precise drilling channel could be clamped with a twisting motion, ensuring a stable positioning. The load-bearing structure of the Plexiglas gauge itself was anchored with screws to the jawbone for maximum resistance of distortion. Drills were...
changed after every three holes to avoid the possibility of inaccurate diameter due to drill wear.

Jawbones were analysed in conebeam computer tomography (CBCT) and the bone quality of the specimen was classified as type D2.

The diameter of each drill hole was recorded with a precision measuring instrument at drillholes depth of 2, 4 and 6mm. Each measurement was taken twice in different orientations. The values of the two corresponding measurements were then averaged.

RESULTS

The drilling performances of inexperienced versus experienced operators in free-hand or template-guided drilling procedures were evaluated by diameter analysis with respect to three different levels of depth measurement.

Intra-individual differences in the diameters of the holes prepared by free-hand drilling by inexperienced persons (group 1) were obvious due to the high variances and standard deviations. Group 1 showed the highest levels of alterations of diameter with a maximum of 2.72mm in a drillhole, measured at depth of 6mm. In contrast, in the group of highly skilled individuals (group 2) representing professional oral surgeons, the variability of the particular free-hand drillholes remains relatively small. Statistical analysis of the average drillhole diameters prepared by these two groups gives very significant differences (p ≤ 0.001), seen at 4mm and 6mm depth of measurement. The degree of deviation is more pronounced than at the depth of 2mm.

In general, the accuracy of drillhole diameter and the deviations from the ideal radius decreased with the depth of measurement. Diameter measurement showed this effect across all experimental groups in this relationship. Differences between values obtained from experienced operators exercising free-hand drilling (group 2) versus template-guided action of experienced operators (group 4) showed statistical relevance at measuring depths of 2 and 4mm (p ≤ 0.001). At the depth of 6mm, no significant differences were observed. Inexperienced handlers using template guidance were represented in group 3. They showed almost comparable and no significantly different results in accuracy as did the group of experienced operators (group 4). High intra-individual differences such as were found in group 1 (without template guidance) were not observed in group 3 (with template guidance) due to lower failure bars. Variability of measured diameters and calculated standard deviation in groups 3 and 4 showed very low values due to a higher level of precision in using template guidance drilling. Highly skilled operators performing free-handed drilling actions, represented in group 2, show the ability to produce drillholes with a comparable level of accuracy as if assisted by template guidance.

In general, very high significances (p ≤ 0.001) were observed between inexperienced free-handed drilling actions (group 1) and the performance of template-guided drilling (group 3 and 4).

CONCLUSIONS

The researchers concluded that template-guided drilling procedures lead to significantly enhanced accuracy compared to free-handed drilling actions were achieved, irrespective of the clinical experience level of the operator.

CLINICAL IMPLICATIONS FOR PRACTICE

These results provide evidence that Template-guided drilling procedures lead to a more predictable clinical diameter. These results need to be confirmed in clinical studies.

Reference


2. The relationship between resting arterial blood pressure and postsurgical pain


Postoperative pain is a common feature of most surgical procedures performed in the oral cavity, such as endodontic treatment, tooth extractions, or periodontal surgery. In order to identify individuals with a high risk of developing severe postoperative pain, preoperative screening methods have been investigated. These studies have assessed the association between perceived intensity of postoperative pain and patient features, tooth characteristics, and surgery variables but only a few studies have examined the relationship between the cardiovascular system and pain perception in human experimental pain models as well as in acute and chronic clinical pain conditions in the orofacial region.

Early experimental data demonstrated an inverse association between blood pressure (BP) levels, electrical dental pain thresholds and pain tolerance levels. More recently, the same significant inverse association between resting BP and acute postoperative pain was observed in patients undergoing nonsurgical root canal therapy. Interestingly, in patients with chronic orofacial pain, elevated resting BP levels were found to be associated, not with decreased sensitivity to acute pain as in healthy individuals but rather with increased sensitivity. Deshaumes and colleagues (2015) from France reported on a study that sought to examine the relationship between resting BP (primary outcome), demographic features of patients, anatomical characteristics of the extracted teeth, surgery variables (secondary outcomes), and acute postsurgical pain in patients undergoing tooth extraction.
MATERIALS AND METHODS
In this prospective observational study, consenting adult patients undergoing ambulatory tooth extraction for pericoronitis, caries, periapical lesions, or orthodontic purposes were enrolled in this study.

All extractions were performed under local anaesthesia using a standardised technique. For impacted or submucosal teeth, the procedure included gingival incision, mucoperiosteal flap elevation, and osteotomy of the contiguous bone with a bur under irrigation, when necessary. About half of the extracted teeth were third molars. All patients received mouth rinses with an antiseptic (chlorhexidine 0.12 %) three times a day for 7 days after the surgery. All patients were prescribed postoperative analgesics (NSAIDS, tramadol or paracetamol, alone or in combination with opioids), but they were instructed to take the drugs only if required. An oral antibiotic was prescribed in case of infected teeth or after a large osteotomy.

To each surgical procedure, there corresponded one observation. Demographic features were weight, height, body mass index, age, and gender. Existence of chronic diseases, including arterial hypertension, and previous surgeries were noted. If patients reported any event of postsurgical or oral pain, they were asked to quote the maximal pain they remembered on a numerical verbal scale (out of 100); this value was set to 0 in case of no history. They were also asked to fill in a questionnaire of hospital anxiety and depression scale. The blood pressure (BP) and heart rate were measured at rest once after the patient was sitting for at least 5 min before entering the operating room.

Surgical features were operator’s qualification, type of operating room, number of extracted teeth and their condition, avulsion of a third molar, concerned jaw, position of teeth on the dental arch, need for osteotomy, suture, root separation, mucoperiosteal flap elevation, and number of cartridges of local anaesthetic used. After surgery, the following were noted: duration of surgery, surgical complications, postoperative nausea or vomiting, spontaneous pain reported on a visual analog scale (VAS) out of 100, recorded every 10 min during the first six hours after the end of surgery in the hospital, the type and dose of every administered analgesic drug, as well as the delay of the first food intake after the end of surgery. An index was created to represent the deepness of implantation (on arch/submucosal/impacted) and the integrity of the extracted tooth/teeth (residual root/intact). Five classes were identified: intact impacted tooth, intact submucosal tooth, intact on arch tooth, impacted root, and submucosal root.

As the prescription of analgesics was freely decided by practitioners, a composite numerical index (referred to as “postoperative pain/analgesia score” or PPAS) was built out of pain values and analgesic drug intake, integrating two intermediate composite numerical indexes of (i) the degree of spontaneous pain reported by the patient (postoperative pain score or PPS) during the first six hours and (ii) the amount of analgesic drug intake (postoperative analgesia score or PAS) during the first three days. For each observation, the mean and maximal pain scores over the 360-min observation time were extracted.

RESULTS
A total of 293 patients (135 women and 158 men) with complete data sets were included in the analysis. Out of the independent outcomes for which significance was reached, only the following were kept for the multivariate analysis: age, anatomy of the extracted teeth, involved jaw, avulsion of a third molar, and mean resting BP. Gender was intentionally kept in the model for adjustment. Other independent outcomes—for which the univariate analysis reached significance—were intentionally not kept to avoid the effect of multicollinearity. Then, history of previous surgery, history of hypertension, duration of surgery, and number of intact teeth extracted were withdrawn.

Univariate analysis reveals that the intensity of postoperative pain is related to age, history of hypertension and previous oral surgery, number of extracted teeth, duration of surgery, and extraction of the third molar. On the other hand, there is no relationship with gender, anxiety, and operation duration. Multivariate analysis reveals that the intensity of acute postoperative pain is only associated with the location (upper/lower jaw, P = 0.004) and deepness of implantation of the extracted tooth (P < 0.0001) and mean resting BP (P = 0.031).

CONCLUSIONS
The authors concluded that patients with high resting BP had lower oral postsurgical pain than those with low resting BP. This suggests that high resting BP is a protective factor against oral postsurgical pain.

IMPLICATIONS FOR PRACTICE
These study findings suggest that the measurement of resting BP before surgery may be used in clinical practice to identify patients at risk of developing severe postoperative pain.

Reference
3. Cognitive status of edentate elders wearing complete denture: Does the quality of the denture matter?


Cognitive impairment is when a person has trouble remembering, learning new things, concentrating, or making decisions that affect their everyday life. Cognitive impairment ranges from mild to severe. With mild impairment, people may begin to notice changes in cognitive functions, but still be able to do their everyday activities. Severe levels of impairment can lead to losing the ability to understand the meaning or importance of something and the ability to talk or write, resulting in the inability to live independently. Cognitive impairment is among the major public health concerns as a result of global increased life expectancy, and population aging. The risk factors for cognitive impairment can be divided into two major categories: non-modifiable (e.g., age, sex, genetic factors, etc.) and modifiable (e.g., hypertension, diabetes, dietary habits, physical activity, cognitive activity).

Poor oral health and non-optimal mastication have been introduced as potential modifiable risk factors for cognitive impairment. Longitudinal cohort studies have linked poor oral health and cognitive impairment such as dementia and Alzheimer’s disease. An association between the number of teeth in the mouth and cognitive status has been reported in published studies. However, little or no data exists on the role of functional quality of dentures in the cognitive status of edentate elders. Cerutti-Kopplin and colleagues (2015) reported on a study that sought to test the hypothesis that quality of denture, via the mastication pathway, will influence the cognitive status in edentate elders.

MATERIALS AND METHODS

This was a cross-sectional study of Brazilian persons aged 60 years or over. Potential candidates were invited to participate in the cohort study by phone call or personal contact. Data was analyzed from edentate participants wearing maxillary and mandibular complete dentures, who had undergone both functional assessment of dentures (FAD) and mini-mental state examination (MMSE) (n = 117). Assessment of cognitive status, quality of denture, and masticatory ability was assessed with the Brazilian version of the mini-mental state examination (MMSE), with higher scores indicating better cognitive status. A trained and calibrated dentist assessed the functional quality of denture as well the history of complete tooth loss for completely edentate elders. The quality of dentures was clinically examined by use of the FAD (functional assessment of dentures) validated instrument. The FAD measure has nine items, which allow the evaluation of the freeway space, occlusion, retention, and stability of dentures. The total range of the scale is 0–9 points, with higher scores indicating better functional quality. Furthermore, masticatory ability was self-assessed by the use of a composite measure (changes in dietary intake, avoiding hard-to-chew foods, and chewing only soft foods because of difficult chewing.

Information on socio-demographic characteristics (age, sex, years of education, income), lifestyle factors (physical and mental activity, alcohol use, and smoking status), and medical history (diabetes, hypertension, heart disease) was obtained using self-administered questionnaires. The geriatric depression scale (GDS) and the short-form mini nutritional assessment (MNA) was used for screening depressive symptoms and nutritional status, respectively.

RESULTS

The sample was comprised of 92 (78.6%) women and 25 (21.4%) men. The mean age of the sample population was 73.7 (SD 5.6) years, with a median of 73 years. Among the individuals, 77.8% reported elementary school as the highest level of education, 60.7% lived in an urban area, most of them were married (70.1%), and 60.7% had a monthly income of less than two times the Brazilian minimum wage (540 USD). The total FAD (functional assessment of dentures) mean score was 5.7 ±2.1, and according to this clinical measure the majority of elders (80%) had adequate maxillary denture, however 67.5% of participants had non-retentive and non-stable mandibular dentures. Unsatisfactory masticatory ability was more frequent in completely edentate individuals with lower FAD total score (p < 0.001) and led to a lower mini-mental state examination (MMSE) total score.

The mean of MMSE score in the total sample was 23.1 (SD=4.4) and was associated with age (p = 0.001), education (p < 0.0001), and depressive symptoms (p = 0.003), as well as perceived masticatory disability (p = 0.001) and functional quality of dentures (p < 0.0001). Perceived masticatory disability was associated with cognitive status (p = 0.002) after adjusting for significant risk factors including age, years of education, and depression. The final model predicted about 25% of the variation of the MMSE score (R2 = 0.246). Masticatory disability contributed to about six percent changes in MMSE score (DR2 = 0.063, p = 0.002).

CONCLUSIONS

These results suggest that cognitive status may be influenced by functional denture quality via the mastication pathway. There is a need for large-scale cohort studies with comprehensive assessments of oral health status, masticatory function, and cognitive activity with both objective and subjective measurement tools.

IMPLICATIONS FOR PRACTICE

The importance of an active masticatory function and its link to cognitive status is highlighted in this paper.

Reference

GENERAL

1. How many classes (classes and subclasses) of drugs are usually involved in the treatment referred to as HAART?
   a. Five
   b. Two
   c. Four
   d. Three

2. The oral lesion most commonly found amongst the sample was:
   a. Parotid enlargement
   b. Herpetic ulcer
   c. Erythematous candidiasis
   d. Pseudomembranous candidiasis
   e. Hairy leukoplakia

3. This study showed that there is insufficient evidence (p >0.05) to demonstrate any significant difference in mean CD4 counts between patients on HAART and those not on HAART in the population.
   a. True
   b. False

Percutaneous Exposure Incidents – prevalence, knowledge and perceptions of dental personnel and students at a dental training site in KwaZulu-Natal. (p 334)

4. The majority of percutaneous injuries to oral health care workers in this study were associated with:
   a. accident with the dental syringe
   b. accident with a surgical elevator
   c. flying debris during scaling
   d. accident with the handpiece and dental bur
   e. accident with scalpel

5. The estimated risk for infection from a blood splash and exposure to HCV-infected blood is 0%-7%.
   a. True
   b. False

6. Post exposure prophylaxis treatment after a percutaneous injury should commence not later than:
   a. 36 hours after exposure
   b. 72 hours after exposure
   c. 12 hours after exposure
   d. 84 hours after exposure

Contamination and disinfection of silicone pacifiers: an in vitro study (p 351)

7. Microwave was less effective than alcohol-free oral rinse in eliminating Candida albicans from pacifiers
   a. True
   b. False

8. Which one of the following microorganisms was tested in the study?
   a. Streptococcus mutans
   b. Escherichia coli
   c. Pseudomonas aeruginosa
   d. Staphylococcus aureus
   e. Lactobacillus

Squamous Cell Carcinoma of the upper lip in an 8 year old child – a case report (p 360)

10. Oral squamous cell carcinoma is:
    a. Found in adults exclusively.
    b. Very commonly found in children.
    c. Rare in children.
    d. Not a neoplasm.

11. The etiologic factors for lip cancer include increased exposure to sunlight, tobacco, viral infections, race, familial, genetic predisposition, immunosuppression, immunodeficiency and occupation?
    a. True
    b. False

12. The p53 tumour suppressor gene is:
    a. An important component of the cell cycle that regulates cell division in mitosis.
    b. Not related to the neoplastic transformation of cells.
    c. Part of the Krebs cycle.
    d. Found exclusively in reptiles.

13. Renal transplant patients:
    b. Are placed on immunosuppressants and have been thought to develop lip cancer.
    c. Have suppressed immune systems due to AIDS.
    d. Have no complications from treatment.
Opportunities for Teledentistry in South Africa (p 342)

14. Teledentistry is viewed by many patients as a risk to their privacy and confidentiality.
   a. True
   b. False

15. Teledentistry has no influence on the numbers of patients referred from rural areas to orthodontists.
   a. True
   b. False

Maxillo-facial Radiology case book 135 (p 363)

16. Hypertelorism is a very common finding in Apert’s syndrome
   a. True
   b. False

17. Syndactyly is a very uncommon finding in Apert’s syndrome
   a. True
   b. False

Clinical Windows (p 314)

18. In the Scherer et al study the authors found that accuracy of drillhole diameter and deviations from the ideal radius decreased with the depth of measurement.
   a. True
   b. False

19. In the Deshaumes et al study, the intensity of postoperative pain was related to gender, anxiety, and operation duration.
   a. True
   b. False

20. In the Cerutti-Kopplin et al study, the mean mini mental state examination (MMSE) score was associated with perceived masticatory disability and functional quality of dentures.
   a. True
   b. False

ETHICS

Irrational requests for extractions (p 364)

21. “First do no harm” – non maleficence is one of the guiding principles of the healthcare sector.
   a. True
   b. False

22. All dentists have the responsibility to provide beneficial treatment, to benefit patients by not inflicting harm, by preventing and removing harm
   a. True
   b. False

23. From an ethical perspective, the patient-centred approach used in health care is in keeping with:
   a. the principle of respect for autonomy.
   b. dentists being honest with their patients at all times
   c. dentists not deceiving patients
   d. telling the truth
   e. All of the above

24. A dental professional must weigh up the benefits and risks of any procedure, and if the potential harm outweighs the benefits, any patient request for treatment should be accepted
   a. True
   b. False

25. National Health Act of No. 61 of 2003 requires that the following information be given to the patient:
   a. Range of diagnostic procedures and treatment options available
   b. Benefits, risks, costs and consequences associated with each option
   c. User’s right to refuse care, in which case the dentist should explain the implications, risks and obligations of such refusal
   d. Furthermore, this information must be provided in a language that the patient understands and in a manner that takes into account the patient’s literacy level.
   e. All of the above

Readers will note that we have reduced the number of General Questions to twenty whilst retaining five Ethics based questions. Our allocation of CPD points remains unchanged. There is optimism that this section will continue to provide members with a valuable source of CPD points whilst also achieving the objective of CPD, to assure Continuing Education.

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   d. for billing, quality assurance, and other administrative functions.
   e. all of the above.

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Branch: Affiliate (Non Branch Member)
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If you are not currently a member of SADA/DPL and would like to apply for SADA membership please speak to the MRO relevant to your provincial area.

Continuing Professional Development
If your enquiry is related to a CPD Accreditation Application or CPD Event, please forward your enquiry to CPD@sada.co.za
Clinical Foundation of Orthopedics, Orthodontics & TMD

2016 Schedule

February

Course VI
Diagnosis and Treatment of T.M.D. Patients
- Diagnosis of Internal & External Derangements
- Stabilization & Finishing of the TMJ
- Orthodontics Including the ALF Appliance
  - Cape Town 9, 10 & 11 Feb
  - JHB 19, 20 & 21 Feb

Course II
Straightwire Therapy
- Delta Force Bracket System.
- Thermal Activated Multi-gradient Arch Wires
- Case Finishing
- Retention
  - Cape Town 12, 13 & 14 Feb

Course I
Complete Maxillofacial Orthopedics
- Diagnose & Treat All Types of Skeletal Imbalances
- Truitt TMJ Evaluation
- Basic Use of the Bimler Elite — Cephalometric Analysis
  - JHB 16, 17 & 18 Feb

1 Day Smile TRU Seminar
February 15th
- Digital Set-ups, Before & After
- Case Presentation
- Pre-Treatment Considerations
- Sequencing Positioners
- Inter Proximal Stripping
  - JHB

TO REGISTER CONTACT HELEN
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