RESEARCH

384 Mapping oral and oropharyngeal cancer research in South Africa

395 The *in vitro* effect of leukocyte- and platelet-rich fibrin (L-PRF) and crosslinked hyaluronic acid on fibroblast viability and proliferation.

400 Patient waiting time and satisfaction at a Tertiary Dental School.

411 Peri-implant diseases at a glance – do we have all the answers?

*Australopithecus anamensis*: A likely ancestor of *A. afarensis*, and lived 4.2 to 3.98 million years ago. Probably a bipedal walker who also climbed trees. The dentition showed small canines and premolars mesiodistally, high molar crowns which were heavily enamelled. The buccal rows were relatively parallel in long narrow jaws. Probably ate mainly fruit and nuts. Changes in the dentition point to evolutionary development to *A. afarensis*. *Source: The Smithsonian Museum of Natural Science.*
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Rene Smulders: Cell: +27 83 291 0543. E-mail: rene@edoc.co.za
A wobbly chair, loose joints and no longer really safe to sit on. Can the situation be remedied? All the instructions agree, to be really effective the joints should be taken apart, the surfaces cleaned and then carefully re-glued into their correct relationships. Taking a chair apart is not as easy as it may sound, despite the joints being loose! There are hidden nails placed by a crafty carpenter, sometimes the adhesive holds tenaciously, there is the risk of fracturing the struts. When joints are obstinate and refuse to let go, one answer is to introduce as much adhesive as possible into the existing joint, working the loose components to force the glue into the recesses, but that result is never as good as having an open and clean joint with which to work, offering security for the future. Now lets sit confidently!

We all have our favourite chairs, and we all have our favourite techniques in the practice of Dentistry. However, if we simply continue to sit unconcerned and are not professionally alert, the joints in our approach to our patients and their problems may also become slack and indeed may be in danger of coming apart. Repair and maintenance are thankfully close at hand and indeed the pages of this issue offer some valuable glue. But there is an additional advantage, for the chair is not now dependent on glue derived from the hooves of animals but on advanced technological developments, and practitioners today have an array of options far ahead of the solutions which have served for many previously quiescent years in Dentistry. We learn in this issue how centrifuged blood may contribute most effectively to healing by concentrating the appropriate biological factors in the area. We are exposed to analyses of epidemiology that are so improved that confident and far reaching conclusions may be drawn on the statistical results. We learn how implants, that great advance in restoring function, have brought a new disease process, peri-implantitis, with which the alert practitioner must cope. We consider how the challenge of providing dental care to the population may be eased by the training of further therapists. And that paper introduces an aspect pertinent to Women’s Month, for the number of Dental Therapy students are nearly equally divided by gender, a far cry from the gender distribution in Dentistry of a few years ago. When I entered Dental School (and I shall not disclose how long ago that was, but, a considerable time!) there was but one female dental student in the Faculty. How different the classes today!

Current statistics tell a story, as at 2nd August 2018, South Africa had 6456 dentists registered by the HPCSA, of whom 2,543 are female. Student figures reflect the change in gender balance, there are 1489 registered students, of whom 934 are female, 63% of our students are female.

The FDI has a Section of Women Dentists Worldwide. Their Executive Board has representatives from several countries, but from Africa only one and she is from Egypt. The Mission of the Section is to:
• coordinate the activities of national groups
• promote the collection of information about women dentists and their pattern of working
• address inequalities where they exist
• facilitate contacts between women worldwide
• enhance their full participation in all branches of the profession.

SADA would be applauded for the recent appointment of another female to the prestigious role of President. Women’s Month exemplified!

The analogy of likening the repair of wobbly chairs to the consolidation of advancing dental knowledge may be a little cumbersome, but consider, sometimes it is only necessary to make a slight adjustment in our approaches – just inject a little glue into the joint, but on other occasions a complete mindset change is essential! a cleaned, separated joint ready to be assembled for enhanced further performance! We should prepare our “chairs” for modification and enhancement at the forthcoming SADA Conference!

We can be confident that as we move ahead into the future, the Presidential Chair is well structured and that our President will ensure it does not suffer wobbly joints.
Health Market Inquiry: What you need to know.

The Health Market Inquiry (HMI) will have a huge impact on the country’s private health sector, patients and how oral healthcare is practiced in the future.

Four years ago, the Competition Commission embarked on the HMI to establish the reasons behind the rapidly escalating cost of private healthcare. The provisional findings of the HMI were recently published in a report and presented at a media conference. The report reveals some of the factors that are preventing, distorting and lessening competition in private healthcare. Recommendations for remedying these to enable greater access to affordable, high quality, advanced healthcare in the private sector are also included.

SADA welcomes the findings of the HMI and consider it to be one of the most comprehensive reports ever compiled on the South African health profession. We believe that if the recommendations are taken seriously, they have the potential to improve healthcare services and to manage costs.

**Control and regulate the over-commercialisation of medical aid schemes:** SADA supports the recommendation to strengthen governance to ensure that schemes deliver value to members, improve value for money and enable the regulator (the Council for Medical Schemes) to exercise more effective oversight. The dental profession has seen a decline in the number of medical benefits being allocated to oral health from 12.6 in 1984, to 2.3 in 2016. Yet, we have seen medical schemes increase the cost of their premiums by over 11% year on year – far exceeding the average of 5% recommended by the Council for Medical Schemes.

**Managing the two-fee component:** The Association also applauds that there is a move to manage scheme administration expenditure and brokers’ fees which are bleeding the system and leaving beneficiaries more vulnerable. At a whopping 84.2%, administration expenditure was the main component of non-healthcare expenditure in 2016 - accounting for 7.3% of gross contribution income. Broker costs represented 14.1% of total non-healthcare expenditure in 2016, up from 13.9% in 2015, with commissions, service fees and other distribution costs increasing by 10% from R1.8 billion in 2015, to R2 billion in 2016, compared with 5.8% in 2015. While these expenses continue to rise, benefit packages cover less and less of the costs of treatment.

**Easily understandable options:** The Commission found that there are too many plan options available, there was very little understanding of what the plans covered and how they compare, as well as there being no measure of the value that consumers are receiving. SADA agrees with the recommendation that medical scheme options must be made easy for members to understand. Currently, healthcare providers are spending inordinate amounts of time explaining to their patients what benefits they have and don’t have, robbing the conscientious practitioner of time in which other patients could be treated. Uncomplicated schemes will mean that all parties benefit, even the schemes themselves since, without their having a clear understanding of the options available, consumers simply choose what they can afford.

**Keeping co-payments:** At the conference where the provisional findings were announced, the issue was raised by the media of the possibility that co-payments may be abolished (as envisaged by the Medical Aid Scheme Amendment Bill). In response, a member of the Inquiry Panel stated that the Commission fundamentally disagreed with this. SADA welcome this stance and believes that it will bestow advantages for both medical aid members and professionals.

SADA is committed to educating members on the findings and recommendations of the HMI and encourages them to be not only cognisant of the issues highlighted, but to address them and act in the appropriate manner highlighted in the report.

The report is now open for public comment until 7 September 2018 before finalisation in November this year.

KC Makhubele: SADA CEO, E-mail:kcmakhubele@sada.co.za
Mapping oral cancer research in South Africa

ABSTRACT
The aim of the present study was to review the scope of oral squamous cell carcinoma (OSCC) research in South Africa, including its epidemiology, diagnosis, associated risk factors and management. All publications relating to OSCC on the South African population were sought. A total of 72 studies were included and classified into seven categories; most studies were case reports or case series. Risk factors and epidemiology were the most investigated categories while early detection and diagnosis was the least explored. All the main ethnic groups in South Africa were investigated. The highest incidence of OSCC in South Africa was reported for males of mixed ancestry; there was a male predominance in all ethnic groups except for Asians. There is a high prevalence of OSCC in younger individuals in comparison with the global average. Future research about early detection and diagnosis, risk factors, premalignant lesions, management and disease progression is suggested. Educational programmes are necessary and should include schools and tertiary education institutions to reach adolescents and young adults.

INTRODUCTION
OSCC ranks amongst the ten most prevalent cancers in the world; being associated with high morbidity and mortality, it constitutes a public health problem.1,2 As in several low and middle-income countries, lack of access to oral health care can delay diagnosis of OSCC and ultimately decreases survival rates.3 It has been recognised that cancers in the oral cavity and oropharynx present wide geographical heterogeneity. In South Africa, OSCC derives from a wide geographical area.2 OSCC in South Africa is the fifth most common cancer in males and the tenth most common cancer in females.5 Globally, 6% of oral cancers occur before the age of 45; in South Africa, 7.3% of oral cancers occur in males in this age group, and 7.8% in females.6 Lifestyle-related factors like smoking, alcohol, betel nut and spices consumption, together with other risk factors such as the human papillomavirus (HPV) and persistent inflammation in the oral cavity, are associated with the aetiology of OSCC.7

METHODS
This report draws on the Arksey and O’Malley methodological framework for scoping reviews.8 Inclusion criteria used to identify potential studies:
1. **Anatomical sites:** oral, oropharyngeal, or both.
2. **Fields of study:** premalignant and malignant lesions, leukoplakia, erythroplakia, combined leukoplakia/erythroplakia, proliferative verrucous hyperplasia, carcinoma-in-situ, verrucous carcinoma, and oral squamous cell carcinoma (OSCC).
3. **Study design:** laboratory studies, case reports, case series, case-control studies, cross-sectional studies (including diagnostic accuracy studies), surveys, cohort studies, randomised controlled trials (RCTs) and other clinical trials, screening studies (using Toluidine Blue, chemiluminescence, brush biopsy, and tissue fluorescence imaging) and qualitative studies.
4. **Population:** South African population samples. International multicentre studies where one or more sites in South Africa were included were also eligible.
Secondary research (e.g. literature reviews) as well as primary studies where the focus was on oral tumours of odontogenic origin, salivary gland origin, tumours of intra-osseous origin, lymphomas, Kaposi’s sarcoma and lesions of melanocyte origin were excluded. Studies on lip cancer were also excluded.

Identification of studies for inclusion
A Medline electronic search (accessed via PubMed) was performed in October 2012 and updated in January 2014 and 2017, according to the search terms displayed in Table 1. Furthermore, hand searching of reference lists of potentially eligible studies was performed during the screening and data extraction process. The heads of the departments of South African universities in the disciplines of Otolaryngology (eight departments), Oral Medicine and Periodontology (four departments), Oral Pathology (four departments), and Maxillofacial and Oral Surgery (three departments) were contacted via email and asked to send any additional studies that could have been missed by the electronic search.

Selection of studies and extraction of data
Two authors independently reviewed the titles from the electronic search results and selected potentially eligible studies. Disagreements were resolved by discussion until a consensus was reached. The articles sent by the heads of departments were screened for their eligibility.

The following data were extracted from the included articles: category (case reports & case series, prevalence & incidence, risk factors, early detection and diagnosis; premalignant lesions; treatment; and progression of disease); study period; study design, sample size, demographics (gender, age, ethnicity), aim/objectives and main findings. Missing data were described as ‘not reported’.

RESULTS
The search results and selection process are displayed in Figure 1. In summary, four-hundred-and-two articles were identified through the Medline search, of which 70 were identified as potentially eligible during the screening process. The 19 emails sent out to heads of departments resulted in 46 articles received, of which 22 were included as potentially eligible. Scrutiny of the full texts resulted in 72 studies that met the eligibility criteria. The included studies were classified into seven categories, as displayed in Table 2. Early detection and diagnosis, premalignant lesions and disease progression were the least investigated categories. The earliest included study included was performed in 1964 and the latest was performed in 2014. All the extracted data were summarised in Tables 3 to 10.

Table 1: Medline search strategy

<table>
<thead>
<tr>
<th>#</th>
<th>Search term</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td><em>Mouth Neoplasms</em>[Mesh]</td>
</tr>
<tr>
<td>#2</td>
<td><em>Tongue Neoplasms</em>[Mesh]</td>
</tr>
<tr>
<td>#3</td>
<td><em>Oropharyngeal Neoplasms</em>[Mesh]</td>
</tr>
<tr>
<td>#4</td>
<td>oropharyngeal dysplasia</td>
</tr>
<tr>
<td>#5</td>
<td>oropharyngeal cancer</td>
</tr>
<tr>
<td>#6</td>
<td>oropharyngeal carcinoma</td>
</tr>
<tr>
<td>#7</td>
<td>oral carcinoma</td>
</tr>
<tr>
<td>#8</td>
<td>mouth carcinoma</td>
</tr>
<tr>
<td>#9</td>
<td>tongue carcinoma</td>
</tr>
<tr>
<td>#10</td>
<td>oral dysplasia</td>
</tr>
<tr>
<td>#11</td>
<td>mouth dysplasia</td>
</tr>
<tr>
<td>#12</td>
<td>tongue dysplasia</td>
</tr>
<tr>
<td>#13</td>
<td>oral precancer</td>
</tr>
<tr>
<td>#14</td>
<td>oral malignant lesion</td>
</tr>
<tr>
<td>#15</td>
<td>mouth malignant lesion</td>
</tr>
<tr>
<td>#16</td>
<td>mouth precancer</td>
</tr>
<tr>
<td>#17</td>
<td>oral cancer</td>
</tr>
<tr>
<td>#18</td>
<td>mouth cancer</td>
</tr>
<tr>
<td>#19</td>
<td>tongue cancer</td>
</tr>
<tr>
<td>#20</td>
<td>oral carcinoma</td>
</tr>
<tr>
<td>#21</td>
<td>mouth precancer</td>
</tr>
<tr>
<td>#22</td>
<td>tongue precancer</td>
</tr>
<tr>
<td>#23</td>
<td>#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22</td>
</tr>
<tr>
<td>#24</td>
<td>“South Africa” or “Western Cape” or “Northern Cape” or “Eastern Cape” or “Southern Cape” or “Kwazulu Natal” or Limpopo or Mpumalanga or “Northern Province” or “Free State” or Gauteng or Johannesburg or Pretoria or Bloemfontein or “Port Elizabeth” or “Cape Town” or Durban or Umtata</td>
</tr>
<tr>
<td>25</td>
<td>#23 and #24</td>
</tr>
</tbody>
</table>
Table 2: Categories of OSCC research

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case reports and case series</td>
<td>12</td>
</tr>
<tr>
<td>Incidence and prevalence</td>
<td>12</td>
</tr>
<tr>
<td>Risk factor</td>
<td>21</td>
</tr>
<tr>
<td>Early detection and diagnosis</td>
<td>3</td>
</tr>
<tr>
<td>Premalignant lesions</td>
<td>7</td>
</tr>
<tr>
<td>Treatment</td>
<td>10</td>
</tr>
<tr>
<td>Disease progression</td>
<td>7</td>
</tr>
</tbody>
</table>

Only one of the included studies was a randomised controlled trial (RCT). Due to the higher prevalence of OSCC among older people, most studies included adults and elderly. All main ethnic groups in South Africa (Whites, Blacks, Asians and people with Mixed ancestry, also referred to as "Coloured", according to the Population Registration Act n.30 of 1950, repealed in 1991[8]) have been investigated in relation to OSCC, which is important due to the potential influence of ethnicity on OSCC.

Several of the included studies lacked clear objectives; amongst those that explicitly stated the objectives, in many instances the design of the study was not ideal to address the objective. For the studies on risk factors for example, most were case series or cross-sectional, which offer limited information on the topic. Similarly, for the treatment category, only one out of the nine included studies was a RCT, which is the most suited design to evaluate the efficacy of an intervention.[67]

<table>
<thead>
<tr>
<th>First author &amp; year</th>
<th>Study period</th>
<th>Study design</th>
<th>Sample size</th>
<th>Demographics</th>
<th>Aims/objectives</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>De Waal 2008[^1]</td>
<td>NR</td>
<td>Case report</td>
<td>1 F adults</td>
<td>To describe a case of OSCC of the tongue</td>
<td>The dentist should always be aware of changes in the oral mucosa, especially in high risk areas of the mouth in patients that smoke and/or consume alcohol.</td>
<td></td>
</tr>
<tr>
<td>De Waal 2008[^2]</td>
<td>NR</td>
<td>Case report</td>
<td>1 M elderly</td>
<td>To describe a case of carcinoma of the gingiva and erosive lichen planus</td>
<td>Identification and control of leukoplakia is necessary in order to decrease the risk of malignant transformation.</td>
<td></td>
</tr>
<tr>
<td>Dreyer 2010[^1]</td>
<td>NR</td>
<td>Case report</td>
<td>1 M adults</td>
<td>To describe a case of OSCC of the anterior mouth floor and dorsolateral tongue surface</td>
<td>This case emphasises the importance of thorough examination of the oral cavity in all patients. For any deviation from the normal, a biopsy should be performed immediately.</td>
<td></td>
</tr>
<tr>
<td>Stander 2013[^2]</td>
<td>NR</td>
<td>Case report</td>
<td>1 M adult</td>
<td>To describe a case of OSCC of the tongue</td>
<td>This case was not typical; although it was associated with smoking and alcohol use, the patient was younger than the average OSCC patient.</td>
<td></td>
</tr>
<tr>
<td>Padayachee 2012[^3]</td>
<td>2009-2011</td>
<td>Case report</td>
<td>1 F adults</td>
<td>To describe a case proliferative verrucous leukoplakia</td>
<td>This case had a single area with a white benign lesion, which transformed into verrucous carcinoma in patients with discoid lupus erythematosus (DLE).</td>
<td></td>
</tr>
<tr>
<td>Padayachee 2010[^4]</td>
<td>NR</td>
<td>Case report</td>
<td>1 M adults</td>
<td>To describe a case of OSCC of the gingiva related to teeth 31 and 41</td>
<td>This unusual case was associated with HIV and mimicked a periodontal lesion that could have been mistaken by a periodontal abscess.</td>
<td></td>
</tr>
<tr>
<td>Mulwafu 2006[^5]</td>
<td>NR</td>
<td>Case report</td>
<td>2 F adults</td>
<td>To describe 2 cases OSCC in patients with discoid lupus erythematosus (DLE).</td>
<td>DLE may have a role in the development of OSCC.</td>
<td></td>
</tr>
<tr>
<td>Nortjie 2005[^6]</td>
<td>NR</td>
<td>Case report</td>
<td>1 M adults</td>
<td>To describe OSCC of the anterior mouth floor - Radiological presentation of spread into mandible</td>
<td>Carcinomas in the mandible may result in paraesthesia, pathological fracture, bone erosion and eventual metastasis to regional lymph nodes.</td>
<td></td>
</tr>
<tr>
<td>Peck 2010[^7]</td>
<td>NR</td>
<td>Case report</td>
<td>1 M adults</td>
<td>To describe two cases of OSCC on the dorso-lateral surface of tongue</td>
<td>OSCC have a variety of clinical presentations, and is not always associated with traditional risk factors of smoking and alcohol consumption. One patient was under 45 years.</td>
<td></td>
</tr>
<tr>
<td>Peck 2012[^8]</td>
<td>NR</td>
<td>Case report</td>
<td>1 M adults</td>
<td>To describe a case of oral submucous fibrosis (OSF) and lichenoid interface mucositis</td>
<td>The rare dual lesion could be associated to areca nut or spices used by the patient. The tissue reaction could have been aggravated by the epithelial atrophy in OSF.</td>
<td></td>
</tr>
<tr>
<td>Feller 2006[^9]</td>
<td>NR</td>
<td>Case report</td>
<td>1 M adults</td>
<td>To describe a case of leukoplakia</td>
<td>A rare case of proliferative verrucous leukoplakia is presented.</td>
<td></td>
</tr>
<tr>
<td>Mamabolo 2006[^10]</td>
<td>NR</td>
<td>Case report</td>
<td>1 M adults</td>
<td>To describe a case of OSCC of the anterior mouth floor</td>
<td>Taking biopsy on chronic ulcers is critical to provide proper treatment, which is guided by the clinical stage of the disease.</td>
<td></td>
</tr>
</tbody>
</table>

[^1]: Age refers to either elderly (>65 years old), (adult (18 to 65 years old), adolescent (12 to 18 years old), or child (<12 years old)
[^2]: Asians include people from Indian descent • M = male; F = female; NR = not reported
**Table 4: Studies in the category prevalence and incidence**

<table>
<thead>
<tr>
<th>First author &amp; year</th>
<th>Study period</th>
<th>Study design</th>
<th>Sample size</th>
<th>Demographics</th>
<th>Aims/objectives</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abram 2012</td>
<td>1997-2001</td>
<td>Data from National Cancer Registry</td>
<td>5470</td>
<td>M+F</td>
<td>All</td>
<td>Whites, Coloured, Black, Asian</td>
</tr>
<tr>
<td>Hille 1996</td>
<td>1988-1991</td>
<td>Data from National Cancer Registry</td>
<td>5396</td>
<td>M+F</td>
<td>All</td>
<td>Whites, Coloured, Black, Asian</td>
</tr>
<tr>
<td>Ndui 2011</td>
<td>1996-2002</td>
<td>Data from National Cancer Registry</td>
<td>9702</td>
<td>M+F</td>
<td>All</td>
<td>Whites, Coloured, Black, Asian</td>
</tr>
<tr>
<td>Breytenbach 1980</td>
<td>NR</td>
<td>Cross Sectional</td>
<td>265</td>
<td>M+F</td>
<td>All</td>
<td>Coloured, Indian, Cape Malay</td>
</tr>
<tr>
<td>Dreyer 1977</td>
<td>1974-1976</td>
<td>Cross Sectional</td>
<td>722</td>
<td>M+F</td>
<td>All</td>
<td>Cape Malay</td>
</tr>
<tr>
<td>Schonland 1968</td>
<td>1964-1966</td>
<td>Cross Sectional</td>
<td>3174</td>
<td>M+F</td>
<td>adolescents, adults, elderly</td>
<td>Black</td>
</tr>
<tr>
<td>Schonland 1969</td>
<td>1964-1965</td>
<td>Cross Sectional</td>
<td>NR</td>
<td>M+F</td>
<td>adolescents, adults, elderly</td>
<td>Blacks, Indian</td>
</tr>
<tr>
<td>Schonland 1969</td>
<td>1964-1965</td>
<td>Cross Sectional</td>
<td>99</td>
<td>M+F</td>
<td>adolescents, adults, elderly</td>
<td>Black</td>
</tr>
<tr>
<td>Walker 1999</td>
<td>NR</td>
<td>Cross Sectional</td>
<td>NR</td>
<td>M+F</td>
<td>All</td>
<td>Asians**</td>
</tr>
<tr>
<td>Altini 1985</td>
<td>1971-1980</td>
<td>Case Series</td>
<td>358</td>
<td>M+F</td>
<td>adults, elderly</td>
<td>Black</td>
</tr>
<tr>
<td>Shear 1970</td>
<td>1965-1968</td>
<td>Cross Sectional</td>
<td>M+F</td>
<td>adults, elderly</td>
<td>Whites, Black</td>
<td>To investigate the distribution of oral cancer in Africans and Whites in Johannesburg</td>
</tr>
</tbody>
</table>

*Age refers to either elderly (>65 years old), (adult (18 to 65 years old), adolescent (12 to 18 years old), or child (<12 years old)

**Asians include people from Indian descent • M = male; F = female; NR = not reported
### Table 5: Studies in the category risk factors

<table>
<thead>
<tr>
<th>First author &amp; year</th>
<th>Study period</th>
<th>Study design</th>
<th>Sample size</th>
<th>Demographics</th>
<th>Aims/objectives</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chandran 2005&lt;sup&gt;21&lt;/sup&gt;</td>
<td>NR</td>
<td>Case Control</td>
<td>134 M+F adults, elderly</td>
<td>Whites, Coloured, Black, Asian</td>
<td>To determine the risk of intraoral cancer associated with tobacco and alcohol</td>
<td>Patients who use tobacco and alcohol had ten times more risk to develop oral cancer, as compared non-smokers and non-alcohol consumers.</td>
</tr>
<tr>
<td>Darling 1993&lt;sup&gt;21&lt;/sup&gt;</td>
<td>NR</td>
<td>Cross Sectional</td>
<td>579 M+F adults, elderly</td>
<td>Whites, Coloured</td>
<td>To determine the effects of cannabis smoking on oral soft tissues</td>
<td>Cannabis users presented higher incidence of leukoedema, dry mouth and traumatic ulcers.</td>
</tr>
<tr>
<td>Van Rensburg 1995&lt;sup&gt;24&lt;/sup&gt;</td>
<td>NR</td>
<td>Case Series</td>
<td>105 M+F adults, elderly</td>
<td>Black</td>
<td>Detection of Epstein-Barr Virus (EBV) in OSCC in a black African population sample</td>
<td>There was no evidence for a direct role of EBV in the process of malignant transformation of intraoral epithelial cells.</td>
</tr>
<tr>
<td>Bissessur 2009&lt;sup&gt;25&lt;/sup&gt;</td>
<td>NR</td>
<td>Cross Sectional</td>
<td>101 M+F adults</td>
<td>Indian</td>
<td>To determine areca nut chewing habits in Durban</td>
<td>Areca nut/chewing still is a common habit among Indians from Durban, South Africa, including among younger age groups.</td>
</tr>
<tr>
<td>Seedat 1988&lt;sup&gt;25&lt;/sup&gt;</td>
<td>1981-1983</td>
<td>Cross Sectional</td>
<td>2058 M+F adolescents, adults, elderly</td>
<td>Indian</td>
<td>To determine the prevalence of betel-nut chewing and submucous fibrosis in Durban</td>
<td>Betel-nut chewing is very prevalent among South African Indians (5%) and can result in serious health problems, including permanent trismus and oral cancer.</td>
</tr>
<tr>
<td>Van Wyk 1993&lt;sup&gt;27&lt;/sup&gt;</td>
<td>1983-1989</td>
<td>Case Series</td>
<td>143 M+F adolescents, adults, elderly</td>
<td>Indian</td>
<td>To investigate the association of areca nut chewing and OSCC in South African Indians</td>
<td>Areca nut use (alone or associated with tobacco) plays a role in the development of OSCC. Eliminating this habit can decrease the risk for OSCC in 89-91%.</td>
</tr>
<tr>
<td>Schoenland 1969&lt;sup&gt;28&lt;/sup&gt;</td>
<td>NR</td>
<td>Cross Sectional</td>
<td>99 M+F adults, elderly</td>
<td>Indian</td>
<td>Upper alimentary tract cancer in Natal Indians</td>
<td>Cancers of the mouth and oesophagus are more prevalent in Indian females than males, which can be related to the higher addiction to betel-chewing amongst females.</td>
</tr>
<tr>
<td>Van Rensburg 1995&lt;sup&gt;23&lt;/sup&gt;</td>
<td>NR</td>
<td>Case Series</td>
<td>66 M+F adults, elderly</td>
<td>Black</td>
<td>Detection of Human Papilloma Virus (HPV) DNA with in situ hybridisation in OSCC in a rural black population</td>
<td>HPV is of limited importance in OSCC carcinogenesis in the studies population.</td>
</tr>
<tr>
<td>Boy 2006&lt;sup&gt;42&lt;/sup&gt;</td>
<td>1998-2003</td>
<td>Case Series</td>
<td>59 M+F adults, elderly</td>
<td>Whites, Coloured, Black, Asian</td>
<td>To investigate the detection of HPV in the oropharynx using real time polymerase chain reaction</td>
<td>There was no correlation between HPV detection and OSCC.</td>
</tr>
<tr>
<td>Fleming 1982&lt;sup&gt;41&lt;/sup&gt;</td>
<td>1965-1979</td>
<td>Cross Sectional</td>
<td>890 M+F adolescents, adults, elderly</td>
<td>Whites, Blacks</td>
<td>To establish whether there are differences in the distribution of oral carcinoma between Blacks and whites</td>
<td>OSCC was more prevalent in Black subjects under 50 years of age as compared to white subjects.</td>
</tr>
<tr>
<td>Hammer 2006&lt;sup&gt;42&lt;/sup&gt;</td>
<td>NR</td>
<td>Case Series</td>
<td>10 NR NR</td>
<td>NR</td>
<td>Is there correlation between ploidy by flow cytometry and chromosome 3 aberration in OSCC</td>
<td>Structural rearrangements involving the long arm of chromosome 3 are infrequent in OSCC.</td>
</tr>
<tr>
<td>Davidson 2014&lt;sup&gt;43&lt;/sup&gt;</td>
<td>1995-1999</td>
<td>Cross Sectional</td>
<td>2900 M+F adults, elderly</td>
<td>Blacks</td>
<td>To examine the presence of human papilloma virus in sample of South African men.</td>
<td>None of the patients who presented oral lesions were positive to HPV.</td>
</tr>
<tr>
<td>Pacella-Norman 2002&lt;sup&gt;44&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>To provide recent estimates of the relative importance of some of the suspected risk factors for oesophageal, lung, oral, and laryngeal cancers</td>
<td>Tobacco was the leading risk factor for all cancers.</td>
</tr>
<tr>
<td>Postma 2003&lt;sup&gt;45&lt;/sup&gt;</td>
<td>1986-1995</td>
<td>Case Series</td>
<td>99 M+F adults, elderly</td>
<td>Whites, Coloured, Black, Asian</td>
<td>To investigate whether the human papillomavirus is a mutual aetiological agent in oral and cervical squamous cell carcinoma</td>
<td>The results support the idea of systemic susceptibility and infection through a common agent, such as HPV, which could contribute to development of SSC.</td>
</tr>
<tr>
<td>Van Heerden 2002&lt;sup&gt;46&lt;/sup&gt;</td>
<td>NR</td>
<td>Case Series</td>
<td>53 M+F</td>
<td>NR</td>
<td>To investigate the suitability of paraffin-embedded material to predict the metastatic potential of OSCC</td>
<td>DNA aneuploidy could predict the metastatic potential of OSCC through DNA flow cytometry from paraffin-embedded primary lesions of OSCC.</td>
</tr>
<tr>
<td>Van Heerden 1999&lt;sup&gt;47&lt;/sup&gt;</td>
<td>NR</td>
<td>Case Series</td>
<td>32 NR NR</td>
<td>NR</td>
<td>Immunohistochemical evaluation of Fhit protein expression in OSCC</td>
<td>Expression of Fhit protein was altered in OSCC, which suggests that the inactivation of Fhit can play a role in oral carcinogenesis.</td>
</tr>
<tr>
<td>Van Heerden 2001&lt;sup&gt;48&lt;/sup&gt;</td>
<td>NR</td>
<td>Case Series</td>
<td>17 NR NR</td>
<td>NR</td>
<td>To investigate the role of Fhit in oral carcinogenesis</td>
<td>Around 60% of OSCC have no expression of Fhit protein, which can play a role in the initiation of OSCC.</td>
</tr>
<tr>
<td>Van Rensburg 1998&lt;sup&gt;49&lt;/sup&gt;</td>
<td>NR</td>
<td>Case Series</td>
<td>55 NR adults, elderly</td>
<td>Black</td>
<td>To determine p53 mutation profile in OSCC of a Black African sample</td>
<td>p53 mutations seem to play a role in oral carcinogenesis. The unique distribution of the mutations suggested different responses to etiological agents.</td>
</tr>
<tr>
<td>Van Heerden 1995&lt;sup&gt;50&lt;/sup&gt;</td>
<td>NR</td>
<td>Case Series</td>
<td>120 M+F adults, elderly</td>
<td>Whites, Black</td>
<td>To investigate the prevalence of Epstein-Barr Virus (EBV) in OSCC in young patients</td>
<td>A possible role of EBV virus in the development of OSCC cannot be excluded, although it does not influence age distribution.</td>
</tr>
<tr>
<td>Van Rensburg 1996&lt;sup&gt;51&lt;/sup&gt;</td>
<td>NR</td>
<td>Case Series</td>
<td>146 M+F adults, elderly</td>
<td>Black</td>
<td>To investigate the presence of HPV DNA in OSCC from an African population sample</td>
<td>HPV is not an etiologic factor in the development of OSCC in the studied population.</td>
</tr>
</tbody>
</table>
### Table 6: Studies in the category early detection and diagnosis

<table>
<thead>
<tr>
<th>First author &amp; year</th>
<th>Study period</th>
<th>Study design</th>
<th>Sample size</th>
<th>Demographics</th>
<th>Aims/objectives</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afrogheh 2012(^{23})</td>
<td>1990-2008</td>
<td>Case Series</td>
<td>60 NR NR NR</td>
<td>NR NR</td>
<td>To evaluate the use of Shandon PapSmear liquid-based oral test (PS LBC) using a novel cytological scoring system</td>
<td>The Shandon PS LBC in association with transepithelial brush biopsy technique is a highly sensitive, specific and economical screening test to detect malignancy. The proposed oral cytological grading system correlates well with histology.</td>
</tr>
<tr>
<td>Rawamugira 2012(^{24})</td>
<td>2007</td>
<td>Randomized Controlled Trial</td>
<td>65 M+F adults, elderly</td>
<td>Black</td>
<td>To determine the uptake of an oral health screening program</td>
<td>Screening uptake should be improved; the strategy used to improve knowledge and awareness was successful (pamphlets).</td>
</tr>
<tr>
<td>Van Heerden 1995(^{25})</td>
<td>1995-2007</td>
<td>Case Series</td>
<td>50 NR NR NR</td>
<td>NR NR</td>
<td>To determine the interobserver reproducibility of the invasive cell grading method on OSCC and to correlate this with the DNA ploidy status and Langerhans cell (LC) population</td>
<td>The method for invasive cell grading is reproducible; however, there was no correlation between the grading results and ploidy status or LC count.</td>
</tr>
</tbody>
</table>

*Age refers to either elderly (>65 years old), (adult (18 to 65 years old), adolescent (12 to 18 years old), or child (<12 years old)  
**Asians include people from Indian descent • M = male; F = female; NR = not reported

### Table 7: Studies in the category premalignant lesions

<table>
<thead>
<tr>
<th>First author &amp; year</th>
<th>Study period</th>
<th>Study design</th>
<th>Sample size</th>
<th>Demographics</th>
<th>Aims/objectives</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Van Wyk 1977(^{26})</td>
<td>1977-1987</td>
<td>Cross Sectional</td>
<td>585 M+F adults, elderly</td>
<td>Coloureds</td>
<td>To determine the oral health status of institutionalized elderly Cape Coloureds from the Cape Peninsula</td>
<td>White lesions were more prevalent in males and positively associated with tobacco use.</td>
</tr>
<tr>
<td>Randeria 1982(^{27})</td>
<td>1982-1987</td>
<td>Case Series</td>
<td>18 Female adolescents, adults</td>
<td>Indian</td>
<td>To describe submucous fibrosis as a premalignant lesion</td>
<td>The epidemiological, clinical and cytological aspects of this study serve as a diagnostic model for early detection of this premalignant lesion.</td>
</tr>
<tr>
<td>Chandran 2013(^{28})</td>
<td>1990-2010</td>
<td>Retrospective Cohort</td>
<td>95 M+F adults, elderly</td>
<td>Whites, Black, Asian, Coloured</td>
<td>To analyse differences in clinicopathological features of oral leukoplakia in different racial groups in the greater Johannesburg area of South Africa</td>
<td>Black South Africans had more non-homogenous leukoplakia (23%) than whites (13%); dysplastic oral leukoplakia was more prevalent in whites (51%) as compared to black South Africans (23%). The floor of the mouth was the most frequently affected site in whites, in black people it was the buccal mucosa.</td>
</tr>
<tr>
<td>Feller 1991(^{29})</td>
<td>1991-1995</td>
<td>Case Series</td>
<td>130 M+F adults, elderly</td>
<td>Whites, Black, Asian</td>
<td>A clinicopathological study of premalignant lesions of the oral mucosa in a South African sample.</td>
<td>Leukoplakia was present predominantly in white males and smokers. The peak age was the 7th decade. The sites most frequently affected were the buccal mucosa and floor of mouth.</td>
</tr>
<tr>
<td>Stein 2008(^{30})</td>
<td>1995-2004</td>
<td>Cross Sectional</td>
<td>9690 M+F adults, elderly</td>
<td>Black</td>
<td>To assess the effects of tobacco smoking on cancer and cardiovascular disease in urban black South Africans.</td>
<td>Risk for cancers of oral cavity/ pharynx was significantly higher among current than never-smokers. Cigarette consumption is relatively low in this population, but the odds ratio for cancer is similar to those from Western countries.</td>
</tr>
<tr>
<td>Van Zyl 2012(^{32})</td>
<td>2000-2008</td>
<td>Case Series</td>
<td>110 NR NR NR</td>
<td>NR NR</td>
<td>To evaluate the use of high-resolution flow cytometry on formalin-fixed, paraffin-embedded tissue of leukoplakia from the tongue and floor of mouth and to correlate the findings with the histologic grading</td>
<td>The ploidy status of premalignant lesions, as determined by high-resolution flow cytometry, may be of value in predicting biological behaviour and malignant transformation of leukoplakia.</td>
</tr>
</tbody>
</table>

*Age refers to either elderly (>65 years old), (adult (18 to 65 years old), adolescent (12 to 18 years old), or child (<12 years old)  
**Asians include people from Indian descent • M = male; F = female; NR = not reported
### Table 8: Studies in the category treatment

<table>
<thead>
<tr>
<th>First author &amp; year</th>
<th>Study period</th>
<th>Study design</th>
<th>Sample size</th>
<th>Gender</th>
<th>Age*</th>
<th>Ethnicity</th>
<th>Aims/objectives</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ebrahim 2011&lt;sup&gt;st&lt;/sup&gt;</td>
<td>2002-2009</td>
<td>Case Series</td>
<td>107</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>To investigate the incidence of metastasis to the submandibular gland in patients with head/neck squamous cell carcinoma</td>
<td>Submandibular gland metastasis from head and neck primary SCC is rare, preservation of the ipsilateral submandibular gland during neck dissection is oncologically safe, except in case of prior surgery or radiotherapy, or primary tumour close to the gland.</td>
</tr>
<tr>
<td>Harris 2011&lt;sup&gt;st&lt;/sup&gt;</td>
<td>NR</td>
<td>Prospective Cohort</td>
<td>47</td>
<td>M+F adults, elderly</td>
<td>NR</td>
<td>Timing of drain removal following head and neck surgery</td>
<td>Drains can be removed safely when volume falls to &lt;50 ml over 24-h period. This would result in less morbidity, shorter hospital stays and cost savings.</td>
<td></td>
</tr>
<tr>
<td>Hudson 1994&lt;sup&gt;st&lt;/sup&gt;</td>
<td>1983-1989</td>
<td>Case Series</td>
<td>15</td>
<td>M+F adults, elderly</td>
<td>NR</td>
<td>The role of suprahypobd block dissection in treating carcinoma of the floor of the mouth</td>
<td>Combined with radiotherapy, suprahypobd block dissection is effective for treatment of nodal carcinoma of the floor of mouth, presenting low morbidity.</td>
<td></td>
</tr>
<tr>
<td>Jones 1992&lt;sup&gt;st&lt;/sup&gt;</td>
<td>1997-1996</td>
<td>Case Series</td>
<td>32</td>
<td>NR adults, elderly</td>
<td>NR</td>
<td>To investigate the survival times relating to major surgery of oral and oropharyngeal carcinoma</td>
<td>Survival at 3 years was 50%, at 5 years was 25%, Prognosis and complications were adversely influenced by advanced TNM staging.</td>
<td></td>
</tr>
<tr>
<td>Mills 1988&lt;sup&gt;st&lt;/sup&gt;</td>
<td>NR</td>
<td>Randomized Controlled Trial</td>
<td>20</td>
<td>M+F adults</td>
<td>NR</td>
<td>To evaluate the suprahypobd approach to treatment of squamous cell carcinoma of the base of the tongue</td>
<td>The suprahypobd approach for OSCC of the base of the tongue provides good exposure, local tumour control and excellent functional outcome.</td>
<td></td>
</tr>
<tr>
<td>Mulwafa 2006&lt;sup&gt;st&lt;/sup&gt;</td>
<td>1999-2004</td>
<td>Case Series</td>
<td>15</td>
<td>NR adults, elderly</td>
<td>NR</td>
<td>To monitor the dose modifying effect of beta-carotene during an intensive course of radiation and chemotherapy when treating OSCC</td>
<td>Beta-carotene seems to be associated with protection of the mucosal membrane within the radiation fields used.</td>
<td></td>
</tr>
<tr>
<td>Van Lierop 2008&lt;sup&gt;st&lt;/sup&gt;</td>
<td>1998-2004</td>
<td>Case Series</td>
<td>8</td>
<td>NR adults</td>
<td>NR</td>
<td>To investigate the expression Fhit content and lymph-node metastasis in OSCC</td>
<td>Although rare, axillary nodal metastasis can occur with primary oropharyngeal SCC, reason why the axilla should be routinely examined in those patients.</td>
<td></td>
</tr>
<tr>
<td>Van Lierop 2008&lt;sup&gt;st&lt;/sup&gt;</td>
<td>1999-2004</td>
<td>Case Series</td>
<td>14</td>
<td>M+F adults</td>
<td>NR</td>
<td>To determine whether total glossoectomy for advanced tongue carcinoma is justified</td>
<td>Total glossoectomy and postoperative radiotherapy is a reasonable option for treatment in developing countries, with higher cure than radiotherapy alone.</td>
<td></td>
</tr>
<tr>
<td>Meyer 2012&lt;sup&gt;st&lt;/sup&gt;</td>
<td>2007</td>
<td>Case report</td>
<td>1</td>
<td>F adults</td>
<td>NR</td>
<td>To evaluate the incidence of submandibular gland metastases in cases of oral cavity OSCC</td>
<td>Survival at 3 years was 50%, at 5 years was 25%, Prognosis and complications were adversely influenced by advanced TNM staging.</td>
<td></td>
</tr>
<tr>
<td>Engelbrecht 2007&lt;sup&gt;st&lt;/sup&gt;</td>
<td>2004</td>
<td>Qualitative Study</td>
<td>2</td>
<td>M adults</td>
<td>White</td>
<td>To determine the quality of life of two participants who had undergone total glosso-laryngectomy</td>
<td>Total glosso-laryngectomy has a high impact on quality of life. Achieving oral communication and having a good support structure can help improve quality of life.</td>
<td></td>
</tr>
</tbody>
</table>

*Age refers to either elderly (>65 years old), (adult (18 to 65 years old), adolescent (12 to 18 years old), or child (<12 years old)  
**Asians include people from Indian descent • M = male; F = female; NR = not reported

### Table 9: Studies in the category disease progression

<table>
<thead>
<tr>
<th>First author &amp; year</th>
<th>Study period</th>
<th>Study design</th>
<th>Sample size</th>
<th>Gender</th>
<th>Age*</th>
<th>Ethnicity</th>
<th>Aims/objectives</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemmer 1995&lt;sup&gt;st&lt;/sup&gt;</td>
<td>NR</td>
<td>Prospective Cohort</td>
<td>386</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>Flow cytometric cellular DNA content and lymph-node metastasis in OSCC</td>
<td>DNA flow cytometry can help determine the risk for metastasis from primary OSCC. Metastasis in diploid tumours appear to be delayed by 2 years.</td>
</tr>
<tr>
<td>Mckenzie 2009&lt;sup&gt;st&lt;/sup&gt;</td>
<td>2006</td>
<td>Case Report</td>
<td>1</td>
<td>M</td>
<td>adult</td>
<td>Asians</td>
<td>Discussion of axillary nodal metastasis at primary presentation of an oropharyngeal primary carcinoma</td>
<td>Although rare, axillary nodal metastasis can occur with primary oropharyngeal SCC, reason why the axilla should be routinely examined in those patients.</td>
</tr>
<tr>
<td>Nadu 2012&lt;sup&gt;st&lt;/sup&gt;</td>
<td>2004-2009</td>
<td>Case Series</td>
<td>69</td>
<td>M+F adults</td>
<td>NR</td>
<td>To evaluate the incidence of submandibular gland metastases in cases of oral cavity OSCC</td>
<td>There was an absence of metastasis to the submandibular gland in OSCC. Patients with early stage OSCC and stage zero neck may be candidates for preservation of the submandibular gland during neck dissection.</td>
<td></td>
</tr>
<tr>
<td>Hemmer 1997&lt;sup&gt;st&lt;/sup&gt;</td>
<td>1986-1995</td>
<td>Prospective Cohort</td>
<td>93</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>To investigate the presence of DNA ploidy in OSCC</td>
<td>Aneuploid tumour cell lines acquire properties that make them capable of invasion and metastasis. Diploid primary tumours have excellent prognosis with radical surgery.</td>
</tr>
<tr>
<td>Hemmer 1996&lt;sup&gt;st&lt;/sup&gt;</td>
<td>NR</td>
<td>Case Series</td>
<td>348</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>To investigate the relationship between flow cytometric DNA ploidy and recurrence of OSCC</td>
<td>There is an association between the DNA ploidy status of the primary tumour and the risk of metastasis.</td>
</tr>
<tr>
<td>Mahomed 2007&lt;sup&gt;st&lt;/sup&gt;</td>
<td>NR</td>
<td>Case Series</td>
<td>30</td>
<td>NR</td>
<td>NR</td>
<td>To determine whether analysis of E-cadherin and b-catenin expression plays a role in tumour progression and loss of differentiation in OSCC, but their use as prognostic markers appears unreliable.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Van Heerden 1999&lt;sup&gt;st&lt;/sup&gt;</td>
<td>NR</td>
<td>Case Series</td>
<td>32</td>
<td>NR</td>
<td>F</td>
<td>NR</td>
<td>To investigate the expression of Fhit protein in OSCC</td>
<td>For mild/moderate epithelial dysplasia, Fhit expression was seen in the superficial layers, while severe dysplastic lesions had absence of Fhit expression. Fhit expression was reduced or absent in 66% of OSCC.</td>
</tr>
</tbody>
</table>

*Age refers to either elderly (>65 years old), (adult (18 to 65 years old), adolescent (12 to 18 years old), or child (<12 years old)  
**Asians include people from Indian descent • M = male; F = female; NR = not reported
DISCUSSION

Case reports/case series
The several case reports and case series highlighted the importance of the biopsy for abnormal lesions in the oral cavity in order to avoid delays in the diagnosis of OSCC. Most cases were associated with tobacco use and alcohol consumption; however, a few cases of OSCC were reported in younger patients in the absence of traditional risk factors.\textsuperscript{15,17} Reports on oral cancer in HIV-infected and discoid lupus erythematosus patients suggest a possible role for these conditions in relation to OSCC.\textsuperscript{14,15} With the alarming statistics for HIV in South Africa, 12.7\% of the population is HIV-positive (Government Statistical Release 2016\textsuperscript{16}); the development of non-AIDS related cancers requires further attention.\textsuperscript{19}

Prevalence and incidence
In South Africa, the National Cancer Registry (NCR) compiles pathology- based data on cancer in the country. The most recent studies on prevalence and incidence of oral cancer in South Africa relies on data extracted from the NCR database. Globally, oral cavity and oropharynx cancers combined account for approximately 5\% of all cancers in males and 2\% of all cancers in females; the number of new cases per year for both genders is estimated at 310,000.\textsuperscript{81} In South Africa, from 1997-2001, 5\% of all cancers in males and 0.6\% of all cancers in females were oral cancers; 0.6\% and 0.1\% were cancers in the oropharynx of males and females, respectively.\textsuperscript{6,21,22}

The average age standardized incidence rate (ASIR) for oral cancer in South Africa from 1996-2001 was 6.2/100,000/year for men and 1.6/100,000/year for women.\textsuperscript{6} The combined ASIR for both genders was 4.5/100,000/year\textsuperscript{29}, which is not far from the global average ASIR of 5.1/100,000/year from the Globocan database.\textsuperscript{1}

Differences among ethnic groups were observed, with Coloured males having the highest ASIR for oral cancer (10.2/100,000/year), followed by white males (6.9/100,000/year). Asian women had the highest ASIR amongst females (3.4/100,000/year), followed by Coloured and White women (both 2.8/100,000/year). The only ethnic group where females had higher ASIR than males was the Asian group. In subjects under 45 years of age, there was no male prevalence.\textsuperscript{6,21}

The majority of oral cancers were diagnosed at the end of the sixth decade; the population average age at time of diagnosis was 57.8 years.\textsuperscript{29} In South Africa, the incidence of cancers in the oral cavity and oropharynx in males (7.3\%) and females (7.8\%) younger than 45 years is higher than the global average (6\%).\textsuperscript{6} Rural populations seem to present lower incidence of OSCC as compared with urban groups.\textsuperscript{26}

Oral cancer in Sub-Saharan Africa presents estimated mortality rate of 2.8/100,000/year for males and of 1.0/100,000/year for females for cancer of the lip and oral cavity combined.\textsuperscript{4} A global estimate from the US for the 5-year relative survival rates for oral cancer is based on the clinical stage at diagnosis, with 82\% for localized lesions, 52\% for regional lymph node involvement and 27\% for patients with metastasis.\textsuperscript{84} It must be pointed out that, since only cancers diagnosed histologically are included in the NCR, the real burden of oral cancer in South Africa can be worse than hitherto reported.\textsuperscript{21}

Risk factors
Traditional risk factors such smoking and alcohol consumption play a crucial role in the aetiology and pathogenesis of OSCC worldwid.\textsuperscript{7} Globally, oral cancer is more prevalent in males and so is smoking; in South Africa the gap among genders is large, while 32\% of adult men smoke, only 8\% of adult women are smokers (WHO report 2015).\textsuperscript{85}

The use of potentially carcinogenic leaf products such as areca nut, associated or not with tobacco, adds to the complexity of aetiological factors for oral cancer in South Africa.\textsuperscript{14} The habit of chewing areca nut can maybe explain the higher prevalence of oral cancer in female South Africans of Indian heritage as compared to male Indian South Africans.\textsuperscript{26,35,37} It has been reported that up to 93\% of adult South Indian African women chew areca nut/quid.\textsuperscript{37}

The potential role of infection with HPV16 and 18 infection in OSCC has been investigated worldwide, especially in non-smoker younger patients.\textsuperscript{26,85} Neither HPV nor Epstein-Barr virus were associated with OSCC in South African subjects.\textsuperscript{34,40,51} One case series investigated alterations in chromosome 3 in relation to OSCC and suggested that mutations in the short arm of chromosome 3 may play a role in the progression of OSCC.\textsuperscript{82}

Globally, low socio economic status has been associated with increased odds ratio for development of oral cancer (OR up to 2.4), measured as low income, educational level and social class.\textsuperscript{88} Furthermore, a pooled analysis of 16 studies showed that each portion of fruit or vegetables consumed per day decreases the risk for oral cancer (OR 0.5).\textsuperscript{89} In a country with much inequity such as South Africa, it is surprising that no study has evaluated the role of low socio economic status and dietary deficiency for oral cancer.

Early detection and diagnosis, premalignant lesions and disease progression
Despite advances in research and surgical techniques, the 5-year survival rate for OSCC remains low, with a rough estimate of 50\%.\textsuperscript{1} The high morbidity and mortality rates emphasize the importance of screening programmes and techniques for early detection of malignancy. Although exfoliative cytology has been investigated as a pre-screening alternative,\textsuperscript{53} the gold standard for diagnosis of cancer of the oral cavity and oropharynx remains the biopsy.\textsuperscript{90} Visual examination is still the best screening tool; guidelines from the American Dental Association suggest that cytology can be useful for patients with suspicious lesions that refuse to undergo biopsy.\textsuperscript{39,91}

Leukoplakia is the most common premalignant lesion, the overall risk for malignant transformation in oral leukoplakia lesions is estimated at 2\%. The majority of leukoplakia (80\%) reported in South Africa affects white subjects.\textsuperscript{46} Oral submucous fibrosis is another recognized premalignant condition, with an estimated malignancy transformation rate of 3.7\%.\textsuperscript{92} Chewing of areca nut, a common habit among Indian and Indian-descendant women, is a significant
risk factor for developing oral submucous fibrosis. More studies are necessary to better understand the carcinogenesis of those premalignant lesions.

It is estimated that in approximately 40% of patients with OSCC, the disease progresses through metastases in cervical lymph nodes, which worsen prognosis and survival rates. Submandibular and auxiliary lymph nodes are rarely affected, but should be examined routinely. Studies have suggested that DNA flow cytometry can help identify the risk for metastasis in primary OSCC tumours. Understanding the progression of the disease and its metastatic potential can help improve survival rates.

The search for prognostic markers of disease progression for OSCC in South African subjects has not yet been successful according to studies on the expression of E-cadherin and b-catenin. Fhit protein has been investigated as a potential prognostic factor, since the tumour suppressant FHT gene seems to be inactivated in severe dysplastic OSCC lesions. Prognosis of tongue cancer has been reported as worse when this protein is under expressed; however the clinical application of this finding is still to be determined.

Treatment
Surgical techniques for oral cancer treatment have been the primary focus of studies on OSCC management in South African subjects, highlighting that most lesions are diagnosed at a late stage. Surgery is the main treatment strategy for oral cancer patients worldwide, especially in advanced stages. A study from 1992 reported a 50% survival rate at 3 years and 25% at 5 years for South Africans submitted to major surgery for OSCC. Radiotherapy is usually used as an adjunctive treatment after surgery for advanced lesions. Chemotherapy has not been commonly used for oral cancer treatment, however, there has been a trend for its use combined with surgery and radiation in advanced or recurrent cases. The use of molecular targeted drugs holds promise on less debilitating treatment options for OSCC patients worldwide.

CONCLUSIONS
OSCC is a significant problem in South Africa, resulting in morbidity and mortality. Ethnic and gender variations are present, with males of mixed ancestry, having the highest incidence rate of OSCC in the country. Smoking and alcohol consumption are strong risk factors for OSCC in the general population. The prevalence of OSCC in young subjects (<45 years) in South Africa is higher than the global average and not always associated with traditional risk factors.

Generally, there is a paucity of information on premalignant lesions, early diagnosis, traditional and non-traditional risk factors, disease progression and management of cancers of the oral cavity and oropharynx in South Africa. Although there seems to be enough information on the epidemiology of OSCC in the country, an underestimation of the incidence and prevalence cannot be excluded.

Various studies mention the need for educational programmes and public health policies targeting risk factors and early identification of lesions, which ideally should translate into less invasive treatment, better quality of life and lower mortality rates. Educational programmes should include schools and tertiary education institutions to reach adolescents and young adults.

Acknowledgements
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The *in vitro* effect of leukocyte- and platelet-rich fibrin (L-PRF) and cross-linked hyaluronic acid on fibroblast viability and proliferation.

**ABSTRACT**

**Introduction:** Leukocyte- and platelet-rich fibrin (L-PRF), an autologous derived platelet and leukocyte concentrate, was first introduced by Choukroun et al. in 2001 and is currently used for several oral and maxillofacial procedures. Hyaluronic acid (HA) is an anionic glycosaminoglycan that shows a wide range of physiological actions, acting as a cellular scaffold, stimulating cell adhesion and migration, as well as having anti-inflammatory effects.

**Aims and objectives:** To investigate the effect of cross-linked HA and L-PRF on fibroblast viability and proliferation.

**Methods:** An *in vitro* laboratory study was conducted at The University of the Western Cape. L-PRF was prepared from a single healthy volunteer and cross-linked HA was obtained from a commercially available product. Analysis was carried out on 3T3 cells using MTT assay.

**Results:** Both L-PRF and cross-linked HA are associated with cell viability and increased cell proliferation. L-PRF had its strongest proliferative effect after 24 hours whereas HA had its strongest effect after eight days (*p* < 0.05). The combination of HA and L-PRF was not significantly better than the control (*p* > 0.05).

**Conclusions:** L-PRF prepared in a specific manner as outlined, as well as commercially available cross-linked HA, is compatible with cell growth and proliferation.

**ACRONYMS**

3T3 cells: mouse fibroblast cell line  
BChD, MSc, MChD, MRD Edin: Department of Oral Medicine and Periodontology, University of the Western Cape.  
clHA: cross-linked Hyaluronic acid  
DMEM: Dulbecco’s Modified Eagle’s Medium  
EDTA: ethylene-diamine-tetra-acetic acid  
EGF: epidermal growth factor  
FBS: foetal bovine serum  
HA: hyaluronic acid  
HGF: human gingival fibroblasts  
L-PRF: leukocyte- and platelet-rich fibrin  
PDGF-AB: platelet-derived growth factor  
TGF-β1: transforming growth factor beta 1  
VEGF: vascular endothelial growth factor

**INTRODUCTION**

Leukocyte- and platelet-rich fibrin (L-PRF), an autologous derived platelet and leukocyte concentrate, was first introduced by Choukroun et al. in 2001 and is currently used for a number of oral and maxillofacial procedures.² The use of L-PRF has gained popularity in the field of surgical implantology, specifically for procedures involving soft and hard tissue augmentation.²,³ The preparation of L-PRF differs from those of previous platelet concentrates in that it involves the use of a single spin protocol that results in an easily manipulated biomaterial that can be applied directly to the site of surgery.¹ It is assumed that the concentrated growth factors associated with L-PRF optimize wound healing and decrease surgical recovery time.²,³ Consequently, L-PRF has been used in various fields, including dermatology and periodontal regeneration.²,³

Hyaluronic acid (HA) is an anionic, glycosaminoglycan.⁶,⁷ It is a naturally occurring molecule that is found in high concentrations in the extracellular matrix of skin, cartilage, bone and periodontal ligament.⁶ Even though the exact function of HA has not yet been established, the molecule shows a wide range of physiological actions, acting as a...
cellular scaffold, stimulating cell adhesion and migration, as well as having anti-inflammatory effects. Commercially synthesized HA, in various forms, has been used in tissue engineering, dermatology, orthopaedics, and more recently, periodontal regeneration. Traditionally, two forms of commercially synthesized HA exist, i.e., non-cross-linked HA, and cross-linked-HA, resulting in different properties and indications for each form of HA.

The aim of the study was to investigate the effect of cross-linked HA and L-PRF on fibroblast viability and proliferation.

MATERIALS AND METHODS

The study was conducted at The University of the Western Cape, Cape Town, South Africa, in 2017. Ethical clearance was obtained from the Research Ethics Committee of the above university (reference number: BM 16/3/31). Informed consent was obtained from the blood donor.

Preparation of the L-PRF

Thirty six milliliters of blood was obtained from a single 56 year old healthy female volunteer. The blood samples were collected in blood collecting tubes that contained clot activator i.e., Vacuette® 9-ml serum tubes with Z Serum Clot Activator (Greiner BioOne International AG, Germany). These were then immediately centrifuged at 400xg for 12 minutes in a standard benchtop centrifuge (PLC-03, Hicare International, Taiwan) as has been previously described. Centrifugation separated the blood into three distinct layers (Figure 1). The layers could be distinguished as a topmost layer consisting of platelet poor plasma, L-PRF in the middle, and red blood cells below. L-PRF was then removed with a sterile forceps, separated from the underlying red blood cells and shredded into smaller fragments using surgical scissors.

Hyaluronic Acid (HA)

A commercially available cross-linked HA (hyaDent BG, Bioscience GmbH) was used in the present study. It is sold as a clear gel contained in a dental anaesthetic-type cartridge and is applied using a dental syringe and a specifically supplied needle. This specific formulation contains 2.0 mg/ml of sodium hyaluronate that is cross-linked with butanediol diglycidyl ether, resulting in a HA molecule with a unique chemical structure.

Cells and Cell Culture

In this investigation, the 3T3 fibroblast cell line was obtained from The National Repository for Biological Materials (Sandringham, South Africa). The 3T3 cells were incubated at 37°C in 5% carbon dioxide and 95% humidity in Dulbecco’s Modified Eagle’s medium (DMEM) with 10% foetal bovine serum (FBS) and 1% penicillin–streptomycin mix. Cells were grown to about 80% confluence and then trypsinized using trypsin-ethylenediamine-tetra-acetic acid (EDTA). The cells were then seeded into 3 x 96-well plates and treated as follows:

- Plate 1 – 1 drop of HA (HA group)
- Plate 2 – 1 drop of HA added to a 1 mm x 1 mm fragment of L-PRF (HA + L-PRF group)
- Plate 3 – 3 mm x 1 mm fragment of L-PRF (L-PRF group)

All the plates had an equal number of controls containing only DMEM. After a culture period of 24 hours to 10 days, each group was removed and proliferation and viability evaluated using the 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay. A minimum of five replicate experiments for each group was performed to ensure reproducibility.

Cell Viability and Proliferation Assay

Cell viability (the metabolic activity of the cell) and cell proliferation (rate of cell division) were measured using the standard MTT assay (MTT, Sigma Chemical Co., Baltimore, MD, USA). The MTT assay or test is a sensitive and quantitative colorimetric assay that measures these parameters. It reflects the capacity of the mitochondria in living cells to convert MTT to purple formazan crystals that can be solubilized with dimethylsulphoxide (DMSO) or isopropanol. This effect is directly proportional to the cell number and is measured with a spectrophotometer at a wavelength of 540 nm. Rapidly dividing cells i.e. cells which show high rates of proliferation, reduce MTT at a faster rate than cells with low proliferative potential. The MTT assay therefore measures the ability of the cell to reduce MTT (viability) as well as the rate of cell division (proliferation). As a result, the MTT assay can also be used to measure cytotoxicity (loss of viable cells) and cytostatic activity (shift from proliferation to quiescence). For the current study, readings were taken from all groups with the control group set at 100%.

Data Analysis

Data from the MTT assay were captured using Microsoft Excel 2010 (Microsoft Corporation, Washington, USA) and statistically analyzed using the one-way ANOVA and Tukey’s test.
RESULTS

With the control group set at 100%, the mean optical densities of each of the test groups were divided by that of the control group and expressed as a percentage of the control value. The data from the MTT assay was correlated, and is presented in Figures 1-4. Statistical analysis is represented by Tables 1 and 2.

According to the results obtained, both L-PRF and cross-linked HA (clHA) as well as the combination of the two materials were compatible with cell viability and proliferation (i.e. none of the tested biomaterials tested displayed evidence of being cytotoxic or cytostatic). Cross-linked HA showed a statistically significant reduction in cell number when compared with the control group at 24 hours (89.98% ± 9.83, p < 0.05). Thereafter cell viability steadily increased, reaching 100.88% ± 6.46 at day 10. Peak cell proliferation associated with HA was seen on day 8 and recorded as 112.20% ± 9.69. This was significantly greater than the proliferation seen in both other test groups for the same time period (p < 0.05). The HA + L-PRF group showed a cell viability of 85.44% ± 12.35 at 24 hours. This was statistically significant (p < 0.05) when compared with the control group, indicating a negative effect on cellular proliferation in the first 24 hours. This difference was not significant for days 2, 5 and 7, but was again recorded on days 8 and 10 (p < 0.05).

The L-PRF group showed the highest cell viability and proliferation after 24 hours (108.99% ± 5.43). This was significantly higher than the other groups tested as well as higher than the control group (p < 0.05). At day 10, no significant differences were seen between all the test groups, however the HA + L-PRF group showed a significantly reduced number of cells as compared with the control (p < 0.05).

A comparison of the proliferative effects of the test groups indicated that both groups containing clHA showed a pattern of cellular proliferation that steadily increased from day 1 to peak at day 8 (clHA group) and day 7 (HA+L-PRF group) respectively. This was different to that observed for the L-PRF group where peak cell proliferation was seen after 24 hours and steadily decreased over the test period (Figure 4.)

DISCUSSION AND CONCLUSIONS

The results from the current study indicate that both L-PRF and cross-linked HA are biocompatible and induce cellular proliferation of fibroblasts in vitro.

L-PRF

It appears as if the effect of L-PRF used in this study is most pronounced in the first 24 hours when compared with any of the other materials tested. This may be due to the high concentration of growth factors present in the material. These include substances such as vascular endothelial growth factor (VEGF), basic fibroblast growth factor (bFGF), platelet-derived growth factor (PDGF-AB), transforming growth factor beta 1 (TGF-β1) and epidermal growth factor (EGF), released from platelets as well as leukocytes.13-16 This initial “proliferative burst” is similar to that seen by Vahabi et al. who reported a statistically significant increase in cellular proliferation of human gingival fibroblasts (HGFs) after 24 hours.17 However, unlike the Vahabi et al. study, which showed a reduction of cell viability of up to 60% after 72 hours, the present study showed sustained cellular viability and proliferation that was statistically similar to the control group for all subsequent test days. The difference in observations in the two studies is difficult to explain without a direct comparison between

Table 1: Comparison between the test groups (one way ANOVA)

<table>
<thead>
<tr>
<th></th>
<th>HA</th>
<th>HA + PRF</th>
<th>PRF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>89.98</td>
<td>91.41</td>
<td>100.88</td>
</tr>
<tr>
<td>SD</td>
<td>9.83</td>
<td>8.79</td>
<td>6.46</td>
</tr>
<tr>
<td>Day 1</td>
<td>85.44</td>
<td>94.72</td>
<td>96.15</td>
</tr>
<tr>
<td></td>
<td>12.35</td>
<td>4.09</td>
<td>2.62</td>
</tr>
<tr>
<td></td>
<td>5.43</td>
<td>9.66</td>
<td>7.64</td>
</tr>
<tr>
<td></td>
<td>0.005*</td>
<td>0.007*</td>
<td>0.439</td>
</tr>
</tbody>
</table>

Table 2: Comparison between the test groups (Tukey test)

<table>
<thead>
<tr>
<th></th>
<th>HA vs Control</th>
<th>HA-PRF vs Control</th>
<th>PRF vs Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>0.02*</td>
<td>0.01*</td>
<td>0.003*</td>
</tr>
<tr>
<td>Day 2</td>
<td>0.03*</td>
<td>0.13</td>
<td>0.045*</td>
</tr>
<tr>
<td>Day 5</td>
<td>0.49</td>
<td>0.08</td>
<td>0.38</td>
</tr>
<tr>
<td>Day 7</td>
<td>0.27</td>
<td>0.31</td>
<td>0.08</td>
</tr>
<tr>
<td>Day 8</td>
<td>0.01*</td>
<td>0.009*</td>
<td>0.13</td>
</tr>
<tr>
<td>Day 10</td>
<td>0.38</td>
<td>0.005*</td>
<td>0.49</td>
</tr>
</tbody>
</table>

(* p<0.05)

Figure 3: HA + L-PRF vs Control (MTT assay).

Figure 4: L-PRF vs control (MTT assay).
the two biomaterials associated with each investigation. Dohan Ehrenfest et al. showed that no significant differences were seen in cell viability and proliferation when measured using the MTT assay over 21 days for HGFs cultured with L-PRF.13 However, the MTT assay was only reported after day three, thereby possibly failing to record any earlier significant findings. Similar to the Dohan Ehrenfest et al. investigation, the present study showed no statistically significant differences when L-PRF was compared to the control group at day 7, and for subsequent days thereafter.13 A recent study investigating the in vitro effect of a modified protocol to produce L-PRF, also showed no significant cell proliferation after 24 hours compared with the control group, suggesting that the protocol used to produce L-PRF in the current study may result in a L-PRF with a different biological effect compared with the abovementioned reports.16 A previous investigation by Peck et al. showed that the L-PRF used in this study has a distinct fibrin architecture with most of the fibres being of a “larger” diameter. 18 Whether this characteristic is significant in the biological behaviour of the biomaterial is still unclear.

**Cross-linked HA**

A limited number of studies have reported on the cell stimulating potential of the specific high molecular weight clHA used in the present study.6,7 Previous research indicates that this formulation is biocompatible and is able to positively stimulate the proliferation of periodontal ligament cells in vitro.6 These results were statistically significant when the biomaterial was diluted at ratios of 1:100 and 1:10. The authors can provide no conceivable reason why the diluted material evoked a higher proliferation rate than the undiluted material. We speculate, however, that this may possibly be due to the reduced viscosity of the material after dilution, thereby allowing better interaction with the growth medium and cell culture.

In the present study we showed that undiluted clHA resulted in a reduction of cellular proliferation for the first few days after cell culture. This was similar to what was observed by Fujioko-Kubayashee et al and colleagues. At day 5, cellular proliferation approximated that of the control group, and, by day 8, was significantly higher than that of the control group (p < 0.05). Therefore an augmented proliferative effect was noticed for the present study. Although HA has well-established water retention properties, the exact mechanism of HA and fibroblast interaction is unclear with “fibroblast stretching” cited as the most likely cause.19 In a recent study evaluating the effect of both clHA and non-cross linked HA on dermal fibroblasts, it was shown that the molecular structure, particularly the type and density of the cross-linkages, play a significant role in the ability of HA to stimulate fibroblast proliferation.19 Any biological effect of synthesized HA is product dependent and the results of each study should therefore be interpreted with this in mind. This might also explain the variations in clinical efficacy of dental related HA that are reported in the literature.

**Hyaluronic Acid and L-PRF**

Because HA has previously been used for tissue engineering and is commercially available for the management of several inflammatory-related conditions, the authors evaluated the cell viability and proliferative potential of a combination of clHA and L-PRF on fibroblasts. As L-PRF has an inherently high concentration of growth factors related to wound healing, it was assumed that the combination of the two biomaterials would stimulate cellular proliferation. The results from the current study indicate that the combined formulation was biocompatible, but had a varied effect on cell proliferation. Similar to clHA, the clHA+ L-PRF mixture showed a significant reduction in cell proliferation after 24 hours. Proliferation then increased over time, and on day 7, it peaked, showing results similar to those of the control group (p > 0.05). This proliferation was opposite to that seen for the L-PRF group. It is interesting to note that the clHA+L-PRF combination showed consistently lower cell proliferation when compared with the control group throughout the time period of the study. Although L-PRF on its own stimulated cell proliferation significantly after 24 hours, it seems the addition of clHA constrained this initial stimulatory effect. Whether this is related to the viscosity of the clHA or its concentration is critical to debate. It is known that diluted forms of clHA seem to better stimulate cell growth, and this might therefore explain the results seen in the present study.6

**CONCLUSION**

L-PRF and clHA are unique biomaterials that are being used in tissue engineering. In the present study, we show that these materials on their own, or in combination, are biocompatible and stimulate cell growth. Interestingly, it appears that this specific method of L-PRF preparation results in a material that has a stimulatory effect that peaks within the first 24 hours. Cross-linked HA also stimulates growth positively, but unlike L-PRF this effect is prolonged over 8 days, implying a different, as yet unknown, mechanism of action. The combination of L-PRF and clHA seems to provide no further advantage to cellular growth when compared with using either of the materials on their own. Based on the above, we can speculate that although L-PRF results in an almost immediate stimulatory effect, that clHA, as a sole treatment choice, might be beneficial in the management of wounds that require more prolonged stimulation. Further research is required to determine the clinical implications of the above findings.

**References**

Patient waiting time and satisfaction at a Tertiary Dental School

ABSTRACT

Introduction: The goal of health care systems is to provide timeous, high quality, equitable and efficient services to patients. Exceptionally long waiting times remain worldwide the primary concern for patients, ahead of service quality attributes such as behaviour and attitudes of staff, communication and service environment. The intention of the patient to revisit or even to refer family to the institution is profoundly influenced by waiting times.

Aim and objectives: To measure the association between satisfaction and patient waiting times, and intention to revisit or to refer others to the Medunsa Oral Health Centre (MOHC).

Methods: A descriptive cross-sectional survey was undertaken over a three month period (August to October) and 149 consenting participants completed a questionnaire. Data on waiting times were collected at every hospital section visited each day.

Results: Mean waiting time for consultations for the 149 participants was 84.84 minutes. Satisfaction over waiting time, state of the Hospital and quality of care ranged between 60% -80%. Perceptions about waiting time, justification of waiting time, intention to revisit and to refer others were significantly associated with patient satisfaction.

Conclusion: Patients who perceive their waiting times to be long are unlikely to revisit or refer family or friends to the facility in future.

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INTRODUCTION

The goal of a health system is to provide quality care and services timeously to all patients. Consequently, health providers invest in systems and activities aimed at providing quality healthcare services to encourage customer satisfaction. Patients who are satisfied with the service they receive are more inclined to return for further appointments or even to refer others to the same practitioner or facility. Despite great innovation and investment in health systems, patient satisfaction remains a major challenge for health care providers, especially nowadays in the era when health care services are regarded as a commodity.

Satisfaction is an emotional state, arrived at because the customer has evaluated the service or product received against their expectations. Healthcare managers ought to recognize patient satisfaction as a necessary and appropriate outcome of the system and that it is an appropriate measure of successful service provision. Patient satisfaction is even more important in relation to the determinants and performance of health services.

Several factors are thought to impact patient satisfaction and related health outcomes. Excessive waiting time to see a doctor or health professional is a frequently cited reason why patients are dissatisfied with healthcare services.

The problem of waiting time in healthcare institutions has been unequivocally ranked the top concern by patients, specifically in the outpatient department, ahead of staff problems, communication, behaviour and attitude. Waiting times for patients presenting at emergency facilities are reported to be the worst compared with those experienced in general care and cold medical cases. Long waiting times threaten access to healthcare and impact on the quality of care provided. Ideally, healthcare should be provided when needed, and without undue delay.

Nowadays, private sector healthcare services are a traded commodity, such that protracted and long waiting times will seriously affect the number of clients processed, and ultimately impact on profit and related bottom lines. Furthermore, waiting times negatively affect the clients’ perception, and hence the reputation, of the facility or
practice and ultimately result in a decreased likelihood of the patients referring others through word of mouth.

For public health institutions such as SMU, which have budgetary constraints, as well as targets set by the provincial department, efficiency is a key performance area. These performance indicators include headcounts, satisfied patients and certain specified waiting times. It is hence mandatory for teaching hospitals to be efficient in the use of resources in order to achieve these national and provincial core standards of care.

Dental teaching institutions have not been extensively studied with respect to this phenomenon yet they post longer waiting times compared with other health facilities. The rigorous treatment protocols and guidelines followed in teaching institutions may be structured to minimise risks, yet they are lengthy, deliberate and often result in an increased consultation time per patient. When student training is taken into account the waiting times extend even further.

This study was conducted to evaluate the waiting times experienced in the emergency departments at a dental teaching hospital in South Africa. This study further sought to determine the association between waiting times and patient satisfaction. Information from this study is likely to be used by managers, doctors, students and other health personnel to improve on waiting times, patient satisfaction and ultimately on the quality of care provided.

METHODOLOGY

Study design and sampling

The study was conducted at Medunsa Oral Health Centre (MOHC), a tertiary teaching oral and dental hospital that forms part of Sefako Makgatho Health Sciences University. This centre is primarily responsible for rendering oral health services to the public, as well as the teaching and training of undergraduate and postgraduate dental students. The facility caters for oral and dental needs of patients from surrounding clinics and hospitals and serves as a referral centre for hospitals from neighbouring provinces North West, Mpumalanga and Limpopo.

A survey was conducted over a period of three months on patients who attended the Maxillo-facial and Oral Surgery department (MFOS) and Emergency department of the dental hospital. These two clinics were chosen because they represent the bulk of emergency relief of pain and sepsis clinical work conducted at the facility. All patients who attended MFOS and Emergency had been examined at the Diagnostics department and referred according to their specific individual needs. These three departments are considered as the gateway to the hospital services, and it is here that the patient gains first impressions of the centre. This exposure often influences the patient’s acceptance of the hospital and hence it is essential to ensure that services in these departments provide a good experience for those attending.

Based on the patient load in the outpatients departments, and relying on a margin of error of 5% and a 95% confidence interval, the required sample size was estimated at 122 participants. Systematic random sampling was used to select every fifth patient receiving care at MFOS and Emergency unit until the required sample size was reached. To be eligible to participate in the study, the individual was required to be receiving treatment on the day of survey, to be of consenting age and capable of making autonomous decisions about treatment.

A previously validated questionnaire was used to collect data and was administered by three calibrated researchers. The researchers remained available to the study participants to provide any required assistance. The first part of the questionnaire contained questions relating to socio-demographic data and waiting time during the visit. The second part was designed to measure the patients’ perception, and views about the delivery of service.

Ethical clearance was granted by the Unisa School of Business Science (UNISA-SBL), and the Management of Medunsa Oral Health Centre granted permission for the study to be undertaken. Participation in the study was voluntary and respondents were informed they could withdraw at any time with no consequences.

Socio-demographic details

Each study participant was requested to provide information about his or her age, sex and socio-economic status. Socio-economic status was measured according to annual individual income or net family income including assets. Participants who indicated an individual income of less than R35 000 per annum or a net family income of less than R75 000 per annum were classified as having a low socio-economic status. Participants who indicated an individual income of more than R35 000 or a family income more than R75 000 were classified as having a medium to high socio-economic status.

Reason for visiting the hospital

Participants were asked to indicate how they came to attend the hospital (whether self-referred or referred by a third party). In addition, participants were asked to indicate the frequency of visits they had made to the hospital (whether first visit, second visit or more) and to report in which department they were currently receiving treatment (whether Emergency or Maxillofacial Surgery).

DATA COLLECTION

Assessment of patient waiting time

Details of every patient entering MOHC are routinely captured by the security personnel for the collection of statistics on daily visits. This study utilised the recording of time at several stages during the period the patients spent in the hospital Time of entry ($T_1$), is recorded on arrival. Patients then wait until the consultation in the Diagnostics department. and $T_2$ is recorded on arrival. Patients then wait for the administration in the Emergency department. $T_3$ is recorded on the consultation sheet for the day. Patients are then released to wait at the reception area for a dental consultation. and on the consultation sheet. $T_4$ is recorded by dental assistants when patients are admitted to the Diagnostics department. Patients are seen by dentists at this section, and $T_5$ is recorded when the consultation is completed and the patient is referred for treatment at MFOS or the Emergency Department (Careline). $T_6$ and $T_7$ are recorded respectively when patients enter and leave these treatment sections. On completion of treatment, all patients are signed out by the security personnel when they exit MOHC, and $T_7$ is recorded (Figure 1).
Based on these recoded data, the following waiting times were computed: - Admin waiting time, WT 1 (T2-T1) being the time elapsed from when the patient entered MOHC to the time he/she was attended by the administration personnel. Reception Wait, WT 2 (T3-T2), the time spent in reception area, before seeing the dentist. Diagnosis Wait, WT 3 (T4-T3), the period spent waiting in the Diagnostic Department before being seen by a dentist. Treatment Wait, WT 4 (T5-T4) the time during which the patient awaited specific treatment at MFOS or Careline, and WT 6 (T6-T5), indicates the time spent actually receiving treatment at MFOS and Careline respectively. Total waiting time at MOHC was computed as T7-T1 (Figure 1).

Participants’ perceptions about waiting time
This study used the dimensions defined by the service quality (SERVQUAL) model, which has been adopted by other studies that explored the perceptions of patients of the quality of various services.15 Questions were adapted from this model to produce direct and indirect close-ended questions. Participants were asked to indicate their perceptions, thoughts and feelings about the waiting time spent in the hospital. The participants were requested to indicate whether they thought the waiting time was “long”, “adequate”, or “short”. In addition, participants had to indicate how they felt about the waiting time – whether they were “satisfied”, “dissatisfied” or “very dissatisfied”. In addition, participants were asked to indicate what were their perceptions regarding the causes of long waiting times which may have been experienced in the overall time spent at the dental hospital. Response options included “Long search for patient files”, “Lost files”, “Large number of patients”, “Doctors arrive late” and “Doctors spend too much time with patients”.

Participants’ views about care and service received
Participants were asked to indicate their views about service attributes such as waiting times, state of the hospital, attitude of the attending dentists, and quality of care received. Standard answers were provided and the participants were required to indicate “yes”, “no” or “not sure” on each of the items.

Statistical Analysis
Statistical data analysis was computed using SPSS version 23, and included measures of central tendency and dispersion. The frequency proportions were collated as a univariate analysis. Inferential statistics, namely t-test and chi-square tests were applied where appropriate to investigate bivariate relationships. Logistic regression analysis was done to determine the influence of factors possibly affecting overall satisfaction. All tests were considered significant at p<0.05.

RESULTS
A total of 149 participants were enrolled in the study. The median age of the participants was 30 years, with a mean of 33.16 and standard deviation of 16.02 years. The greater proportion (55.7%) of the participants were between 21 and 40 years of age. Other characteristics of the participants are presented on Table 1. Most of the participants were female (62.4%) and mainly hailed from low socioeconomic backgrounds (78.5%).

![Figure 1: Patient flow and recording of waiting time.](image)

| Table 1: Descriptive Characteristics of Participants |
|-----------------------------------|-----------------|
| **Variable**                      | **Percent (Frequency)** |
| Gender                            | **N=149**        |
| Male                              | 37.6 (56)        |
| Female                            | 62.4 (93)        |
| SES (Income)                      |                 |
| Low                               | 21.5 (32)        |
| Medium to High                    | 78.5 (117)       |
| Referral                          |                 |
| Self                              | 16.1 (24)        |
| Third Party                       | 83.9 (125)       |
| Clinic Visited                    |                 |
| MFOS                              | 30.9 (46)        |
| Emergency                         | 69.1(103)        |
| Frequency of Visits               |                 |
| Once                              | 39.6 (59)        |
| Twice or More                     | 60.4 (90)        |
Details of the waiting times and time spent in the various Departments are shown on Table 2. The average waiting time before being seen at Diagnostics was 84.84 minutes. Of the time spent in consultation, the examinations accounted for the shortest time, 45.84 minutes as opposed to 52.75 and 80.38 minutes for MFOS and Emergency Departments respectively. The mean total cumulative time spent with doctors during treatment was approximately 110.94 minutes. Overall, it takes an average of four (4) hours for patients to interact with the system and to complete any form of emergency treatment at MOHC on any given day.

The data in Table 3 seem to indicate that most of the participants (40-64%) thought the waiting time was either as expected or short. Furthermore, approximately 80% of the participants were satisfied with the length of waiting time. Table 4 shows the reasons perceived by the participants for long waiting times. These included late arrival of doctors, doctors taking a long time to treat patients, the large volume of patients and protracted time waiting to receive a file.

According to Table 5, participants generally indicated that they were satisfied with the waiting times and care received at the hospital. A high percentage of participants indicated that the waiting time they experienced was justified. Similarly, the majority of the participants were satisfied with the state of the hospital and the care received at the hospital. An overwhelming majority (85.9%) of participants indicated their intention to visit the hospital again in the future as well as a willingness to refer friends and family to MOHC in the future (81.9%).

The logistic regression analysis of factors associated with patient satisfaction is shown on Table 6. These results suggest that an increase in the waiting time prior to being attended to by the dentist and an increased length of time spent with the dentist was associated with a decrease in the satisfaction reported by the participants. Surprisingly however, patients who spent more time in the hospital were in general more likely to be satisfied than those who spent less time.

**DISCUSSION**

The mean age for the participants in our study was 33 years, slightly lower than the average ages of 38 cited by other literature, 5 but consistent with other health research. More females than males attended at MOHC, as reported by Jawaid et al. This finding is consistent with health seeking behaviour theories which consider that females report higher morbidity while males are prone to high mortality rates due to their failure to seek care early or to engage in preventive and promotive health care. The average waiting time observed in this study is comparable to reported mean waiting times at medical facilities, ranging below the average of some studies and being relatively longer than other reports. This study, conducted in an oral and dental health care facility, did
not reveal significantly different findings in terms of waiting time and patient perceptions from data related to medical care facilities.

The most common reason put forward by patients to account for the long waiting times is that dentists arrive late (but then spend less time in attending to them). This finding is also articulated by Feddock et al. and by Anderson et al. At MOHC, as in other dental schools, dentists may be delayed due to their grappling with a multiplicity of responsibilities. These include clinical service rendering to patients, lecturing and teaching students, clinical supervision of students and research related-activities. Invariably, more time is spent per patient as compared with district health facilities, culminating in increased waiting times, extended treatment time and total time in the facility. High patient waiting times reported in the study can be attributed to large daily volumes of patients seeking oral and dental care at MOHC, which is one of the three tertiary referral centres servicing the densely populated Gauteng province. This pattern of extended waiting times and delays is common to teaching institutions.

The organizational structure and plans for the filling of posts at MOHC, like other public facilities, is determined largely by budgetary allocations from the Department of Health. In the recent past, the Department has largely by budgetary allocations from the Department of Health. In the recent past, the Department has experienced serious financial difficulties leading inexorably to increased vacancies at MOHC. These have precipitated unfavourable doctor-patient ratios, which have further exacerbated long waiting times. Dental schools across South Africa report similar staff shortages, long patient volumes and waiting times. Surprisingly, few of the participants indicated a perception that dentists spend too much time in consultation with patients.

The perception of patients that dentists arrive late for clinical sessions may be an indication that standards of professionalism may be compromised. Lapses in professionalism and performance, while not objectively assessed in this study, have been reported by patients as contributing to long waiting times. The perception that dentists are not timeous in attending to patients is a factor that cannot be overlooked. Health personnel need continually to conduct themselves in a professional manner as their patients hold them in high esteem due to their status in the discipline Dentists may need to make greater efforts to be consistently punctual for the patients such that they are not perceived to be late or absent for service rendering. Alternatively, patients should be informed of how long, realistically, they may have to wait for the dentist to be available.

In addition, long queues for files at the administrative area was indicated as a reason for extended waiting time experienced by patients. Therefore, it is fundamental that administrative processes should be streamlined to avoid delays and improve patient flow. Novel engagement of patients during this time can also drastically improve the perception of waiting time and overall satisfaction. The activities to fill this time cannot be mundane and generic but need to be designed in such a way that they cater for the needs of the possible niche market of patients reporting for care. Materials such as educational videos, health talks and readable material have been used. However, recent literature also indicates that the use of visual art can also alter the patient’s experience and behaviour pattern, thereby positively influencing the perception of waiting time. This finding calls for research into more activities that would, without causing stress, cater for patients who present with pain. Pain has been associated with a greater likelihood of being dissatisfied. Staff managing these patients should be informed of the role pain plays in perceived satisfaction and asked to proactively accommodate patients in pain in the outpatient clinics.

This study shows a positive association between satisfaction and future prospects about the services at MOHC. The majority of patients who are satisfied with services intend revisiting the centre in the future, indicating that intention to revisit and to recommend the facility to others is a strong, significant and reliable proxy for satisfaction.

**CONCLUSION**

Waiting time is the single most important contributor to patient satisfaction.

**Recommendations**

The Health Manager should introduce efficient process along the entire supply chain in order to improve waiting times. Furthermore, patients should be positively engaged whilst waiting for service so as to alter their perception of waiting times. Interventions such as videos, magazines, health talks, visual art and information by oral health personnel, have proven benefits.

**References**


Dental Therapy Student cohorts: Trends in enrolment and progress at a South African University.

**SUMMARY**

**Introduction:** The urgent need to train a great many dental therapists to alleviate the shortage of oral health personnel has long been recognised.

**Aims and objectives:** To describe trends in enrolments, examination pass rates and graduations of cohorts of dental therapy students at Sefako Makgatho Health Science University during the decade 2004 to 2014. The number of students who completed their degree and graduated within the regulation time was also determined.

**Design:** A cross-sectional descriptive study.

**Methods:** Academic records of cohorts of dental therapy students for the period 2004 to 2014 were reviewed. Data related to demographic characteristics, numbers enrolled, numbers who dropped out, and numbers who graduated were acquired and then captured in Microsoft Excel software.

**Results:** The median number of enrolled students in all years was 36. The maximum number of first year enrolment was 21. More female students than male students enrolled and graduated. The aggregate examination pass rate was in the low 80s. The number of graduates was less than a third of the number enrolled. Less than half of all students who had registered initially successfully completed the course in the regulation time.

**Conclusions:** Both student enrolment and graduations are on an upward trajectory.

**INTRODUCTION AND BACKGROUND**

The Saskatchewan Dental Therapists Association defines dental therapists as primary oral health care professionals who are trained to perform basic clinical dental treatment and preventive services within a variety of practice settings. In South Africa, dental therapists were initially trained to undertake their scope of practice under the supervision of a qualified dentist in public dental service as a part of the multi-disciplinary healthcare team. Dental therapists have been allowed to practice independently since October 1992. They focus on the holistic care of patients, which ranges from prevention of oral disease and promotion of oral health to the alleviation of oral abnormalities, pain and disease. They also function in the fields of preventive, promotive and rehabilitative health, on primary, secondary and tertiary levels.

The structural ills of the Health System which necessitated the founding of the dental therapy profession in South Africa have not yet been adequately corrected. The problems include, among other factors, a shortage and an inequitable distribution of oral health personnel, a lack of dental services at primary health care level, high attendance rates where services are available and accessible and the limited range of services offered. Dental caries is a common childhood disease in the country despite the fact that National Oral Health surveys indicate a positive trend of decreasing severity. The latest survey found that more than 80% of dental caries in children was untreated. New oral health priorities, which include conditions such as periodontal disease, oral manifestations of HIV/AIDS, dental trauma, oral cancer and craniofacial anomalies, are now under consideration, adding to the burden.

The urgent need to train a great many dental therapists to alleviate the shortage of oral health personnel has long been recognised. The human resource plan of the National Department of Health envisaged an increased annual output of 600 dental therapists from a baseline of 25. Traditionally, four methods of calculating health personnel requirements have been applied: health-care demands, health-needs approach, personnel to population ratios, and service targets. Oral health personnel, including dental assistants, oral hygienists, dental therapists, and dentists, have been estimated to constitute 0.2 per 1000 population. A meagre dental therapist to population ratio of 0.13 per 10,000 has been calculated. At the time of the study, seven hundred and eight dental therapists were registered with the Health Professions Council of South Africa. Dental therapy training is currently offered at the Dental Schools of the Universities of KwaZulu-Natal and Sefako Makgatho Health Science University.
Health Sciences University. A survey of the application, enrolment and graduation records of the University of KwaZulu-Natal for the period 2001 to 2010 was recently performed. That study found a linear increase in enrolment from 60 to 81 and an upward shift of around a mean of 16 graduates per year.25

Training of dental therapists is also offered at Sefako Makgatho Health Science University and in view of the motivation to enhance the numbers of dental therapists in the country, a study of the contribution of that programme is warranted.

OBJECTIVES OF THE STUDY
• To describe the demographic characteristics and trends in enrolments and graduations of dental therapy student cohorts of Sefako Makgatho Health Sciences University for the period 2004 to 2014.
• To describe trends in the examination pass rates for the first, second and third years of study.
• To determine the median number of students who completed their degrees and graduated within the regulation time.

MATERIALS AND METHODS
Study design
This was a cross-sectional descriptive study in which existing academic records were reviewed.

Target population
The study population consisted of the academic records of cohorts of dental therapy students who were enrolled at Sefako Makgatho Health Sciences University during the period 2004 to 2014.

Study sample
Every available record was studied, yielding a total of 423 files.

MEASUREMENTS
Academic records
Data related to the demographic characteristics of the students, the numbers enrolled, numbers who dropped out, and the numbers who graduated were acquired and then captured in Microsoft Excel software.

Definition of variables and terms
Age and gender refer to student age and sex as recorded in the academic records.

Population group breakdown of students into African, Indian, Coloured and White was applied according to the Population Registration Act of 1950.26

Regulation time is the period of time normally expected for completion of the degree (three years).

Throughput, quite simply, is how many students who started studying completed the course of study. This may also be measured by the number of students who do not “drop out”.27

Ethical considerations
Ethical approval for the study was granted by the Ethics Committee of the Sefako Makgatho Health Sciences University (SMREC/D/1820/2017). Permission to conduct the study was granted by the Chief Executive Officer (CEO) of the Medunsa Oral Health Centre.

STATISTICAL ANALYSIS/HYPOTHESIS TESTING
Collected data were subjected to univariate and bivariate analysis in Statistical Analysis Software (SAS) software. Frequencies, medians and proportions were calculated. Chi-squared tests were performed to test the statistical significance of the differences in proportions.

The chosen significance level of the tests was a p-value less than 0.05.

RESULTS
Academic records of dental therapy student cohorts for the period 2004 to 2014 were analysed.

Demographic characteristics

<table>
<thead>
<tr>
<th>Cohorts</th>
<th>Population Groups</th>
<th>African N (%)</th>
<th>Indian N (%)</th>
<th>Coloured N (%)</th>
<th>White N (%)</th>
<th>Total N (%)</th>
</tr>
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<tbody>
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<td>2 (6.1)</td>
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<tr>
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<td>0 (0)</td>
<td>38 (100)</td>
</tr>
<tr>
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<td>0 (0)</td>
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</tr>
<tr>
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<td>39 (100)</td>
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<td>0 (0)</td>
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</tr>
<tr>
<td>2012</td>
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<td>2 (5.3)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>39 (100)</td>
</tr>
<tr>
<td>2013</td>
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<td>2 (4)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>50 (100)</td>
</tr>
<tr>
<td>2014</td>
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<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>58 (100)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>397 (93.9)</td>
<td>19 (4.5)</td>
<td>5 (1.2)</td>
<td>2 (0.4)</td>
<td>423 (100)</td>
</tr>
</tbody>
</table>

The overall median number of enrollees in the first, second, and third years of study between the years 2004 and 2012 was 36 with an interquartile range of 32 to 39. Enrolments have been on an upward trajectory since 2012 when significant growth (28%) was experienced. The overwhelming majority (93.9%) of students were African. White, Coloured, and Indian students together comprised only 6.1% of the enrollees.
The median number of first year enrollees during the decade between 2004 and 2014 was 14 with an interquartile range of 10 to 20. A statistically significant (p< 0.05) sharp increase in enrolment was experienced in 2008. A steady increase in enrolment was recorded between the years 2010 and 2012. More female students than male students were enrolled. There was strong evidence of a trend of increased proportion of female student enrolment in the population (p< 0.05).

The mean pass rate during the decade between 2004 and 2014 was 83.6% (SD 10.6). There was insufficient evidence to reject the null hypothesis of no trend in the proportion of students who passed the examination in the population (p> 0.05).

The median number of second year enrollees during the decade between 2004 and 2014 was 11 with an interquartile range of 7 to 16. A statistically significant (p< 0.05) sharp decrease in overall enrolment was experienced in 2008. Female students constituted 55.6% of the cohort. There was insufficient evidence to reject the null hypothesis of no trend in the proportion of female student enrolment in the population (p> 0.05).

The mean pass rate during the decade between 2004 and 2014 was 80.2% (SD 14.7). There was insufficient evidence to reject the null hypothesis of no trend in the proportion of students who passed the examination in the population (p> 0.05).

The median number of third year enrollees during the decade between 2004 and 2014 was 13 with an interquartile range of 9 to 15. A statistically significant (p< 0.05) sharp decrease in overall enrolment was experienced in 2008. Female students constituted 60.9% of the cohort. There was insufficient evidence to reject the null hypothesis of no trend in the proportion of female student enrolment in the population (p> 0.05).

The mean pass rate at the third year of study during the decade between 2004 and 2014 was 91.4% (SD 9.3). There was insufficient evidence to reject the null hypothesis of no trend in the proportion of students who passed the examination in the population (p> 0.05).

The median number of second year examination pass rate

<table>
<thead>
<tr>
<th>Cohorts</th>
<th>Examination Results</th>
<th>Pass n (%)</th>
<th>Fail n (%)</th>
<th>Total</th>
<th>Chi-squared test for trend</th>
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<tr>
<td>2007</td>
<td>5 (71.4)</td>
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<tr>
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<td>1 (10)</td>
<td>11 (100)</td>
<td></td>
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<tr>
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<tr>
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<td>4 (40)</td>
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<tr>
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<td>5 (33.3)</td>
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<tr>
<td>2014</td>
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<td>4 (40)</td>
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<tr>
<td>Total</td>
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The mean pass rate at the third year examination pass rate

<table>
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<tr>
<th>Cohorts</th>
<th>Examination Results</th>
<th>Pass n (%)</th>
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<td></td>
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<tr>
<td>2010</td>
<td>11 (100)</td>
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<td>11 (100)</td>
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<tr>
<td>2011</td>
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<tr>
<td>2012</td>
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<tr>
<td>2013</td>
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<td>2 (15.4)</td>
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<tr>
<td>2014</td>
<td>15 (100)</td>
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<td>15 (100)</td>
<td></td>
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<tr>
<td>Total</td>
<td>117 (91.4)</td>
<td>11 (8.6)</td>
<td>128 (100)</td>
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was insufficient evidence to reject the null hypothesis of no trend in the proportion of students who passed the examination in the population (p> 0.05).

### Table 9: Trends in graduations by gender

<table>
<thead>
<tr>
<th>Cohorts</th>
<th>Gender</th>
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<th>Male n (%)</th>
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<td>4 (33.3)</td>
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<tr>
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<td>9 (81.8)</td>
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<td>7 (50)</td>
<td>14 (100)</td>
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<tr>
<td>2012</td>
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<td></td>
</tr>
<tr>
<td>2014</td>
<td></td>
<td>8 (53.3)</td>
<td>7 (46.7)</td>
<td>15 (100)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>72 (61.5)</td>
<td>45 (38.5)</td>
<td>117 (100)</td>
<td></td>
</tr>
</tbody>
</table>

The median number of graduates per year was 11 with an interquartile range of 7 to 14. A statistically significant (p< 0.05) steep decline in overall graduations was experienced during the years 2005, 2009 and 2012 respectively. During the decade between 2004 and 2014, with the exception of 2005 and 2009, more females than males earned dental therapy degrees. There was insufficient evidence to reject the null hypothesis of no trend in the proportion of female student graduations in the populations (p> 0.05).

### Table 9: Numbers of students who completed their degree and graduated within the regulation time

<table>
<thead>
<tr>
<th>Cohorts</th>
<th>Year of study</th>
<th>Number of Graduates</th>
<th>Throughput (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First N</td>
<td>Second N</td>
<td>Third N</td>
</tr>
<tr>
<td>2004</td>
<td>10</td>
<td>9 (1)</td>
<td>7</td>
</tr>
<tr>
<td>2005</td>
<td>14</td>
<td>9 (3)</td>
<td>9</td>
</tr>
<tr>
<td>2006</td>
<td>9</td>
<td>8 (1)</td>
<td>8</td>
</tr>
<tr>
<td>2007</td>
<td>7</td>
<td>3 (3)</td>
<td>2</td>
</tr>
<tr>
<td>2008</td>
<td>20</td>
<td>13 (3)</td>
<td>9</td>
</tr>
<tr>
<td>2009</td>
<td>14</td>
<td>10 (3)</td>
<td>8</td>
</tr>
<tr>
<td>2010</td>
<td>13</td>
<td>5 (5)</td>
<td>4</td>
</tr>
<tr>
<td>2011</td>
<td>16</td>
<td>10 (2)</td>
<td>8</td>
</tr>
<tr>
<td>2012</td>
<td>21</td>
<td>14 (3)</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>124</td>
<td>81 (24)</td>
<td>64</td>
</tr>
</tbody>
</table>

The median percentage of students who started the course, completed the degree and graduated within the regulation time during the decade between 2004 and 2014 was 45 with an interquartile range of 37 to 58.5. Nineteen percent (24/124) of students who started the course dropped out. A little less than a third (39/124) of the students took longer to qualify.

**DISCUSSION**

Trends in enrolments, examination pass rates and successful graduations of cohorts of dental therapy students at Sefako Makgatho Health Science University during the period 2004 to 2014 were examined.

**Demographic characteristics**

The current study observed a progressive rise in the proportion of female student enrolment during the decade between 2004 and 2014 (51.5 % in the first year, 55.6% in the second year, and 60.9% in the third year of study respectively). This study produced results which corroborate the findings of a great deal of work in the field of oral health research.28-30 The 60:40 female: male ratio in the third year of study is consistent with that reported by Singh and Combrink (2011).26 A possible explanation for the change in gender distribution might be that more male than female students either repeat or drop out of the course.

The demographics show that the overwhelming majority (94%) of the enrolees were African and that White, Coloured, and Indian students together comprised only 6% of the cohorts. The present findings seem to be consistent with those reported by Singh and Combrink (2011) which found that White and Coloured students are under-represented among dental therapy student registrations.26 A possible explanation for this might be that the results reflect the historical circumstances under which the dental therapy profession was introduced in South Africa.31,32 The low number of White, Coloured, and Indian students is an important issue for future research.

**Enrolments**

Relevant findings were that during the decade between 2004 and 2014 an average of 36 students (first, second and third year) were enrolled and that the maximum number of first year enrolment was 21. These results differ from those of Singh and Combrink (2011) who reported a substantially higher overall (81) as well as first year (30) enrolment at the Dental School, University of KwaZulu-Natal.25 In contrast to the increased first year enrolment experienced at Sefako Makgatho Health Science University, the University of KwaZulu-Natal experienced an exponential increase during the period under review.25 However, the low combined overall enrolment at both dental schools implies that the proposal of the National Department of Health that the annual output of dental therapists be increased to 600 will remain a pipedream, unless factors that limit or restrict enrolment are addressed. These include, but are not limited to, the availability of preclinical and clinical training facilities and human resources.

An important finding was that enrolments went up 28% in the year 2013. This result, however welcome, is not very encouraging for the reason that in contrast to the increased first year enrolment experienced at the University of KwaZulu-Natal,26 this growth at Sefako Makgatho is attributable to an increase in enrolments at the second and third years of the course.

**Examination pass rate**

The results of this investigation show that the examination pass rate was intermediate in the first year, low in the second year and high in the third year of study. These results have not previously been described. It may be that the low examination pass rate in the second year of study is due to the fact that some of the students who transfer to dental therapy from other programs are underprepared.
Graduations
The study found that on average 12 students graduated each year during the decade between 2004 and 2014. This number of graduates is lower compared with that (16) produced at the University of KwaZulu-Natal. However, the ratio of overall enrolment to the number of graduates at Sefako Makgatho Health Sciences University (1:3) compares favourably with that at the University of KwaZulu-Natal (1:5)\(^{2,5}\).

The data showed that more female than male students earned dental therapy degrees at SMU. The findings of the current study are consistent with those of Singh and Combrink (2011) who found that 60.5% of graduates at the University of KwaZulu-Natal were female.\(^ {2,5}\)

Throughput
The current study found that less than half (45%) of all students who started the course during the decade between 2004 and 2014 finished it in the regulation time. This rather disappointing result has not previously been described. It is difficult to explain this result, but it may be largely related to the low second year examination pass rate and the 19% course dropout rate.

Limitations of the study
Data on the ages of the students were not available.

CONCLUSIONS
Both student enrolment and graduations are on an upward trajectory.

References
33. Singh PK, Combrink M. Profile of the dental therapy graduate at the University of KwaZulu-Natal. South African Dental Journal 2011; 66(10): 468,470-4.\(^ {23}\)
34. Africacheck.org/factsheets/factsheet-many-south-african-students-graduate/ [Accessed 01 November 2017].
35. Africacheck.org/factsheets/factsheet-many-south-african-students-graduate/ [Accessed 01 November 2017].
As many as 1 in 3 people suffer from dentine hypersensitivity. New Sensodyne Rapid Relief is clinically proven to deliver fast relief in just 60 seconds and long-lasting protection from dentine hypersensitivity, helping to bring everyday improvements to your patients’ lives.
Peri-implant diseases result from chronic inflammatory processes within the tissues surrounding an intra-oral implant. The incidence of the disease is increasing at an alarming rate. Bacterial infections are amongst the several factors that may play roles in the pathogenesis of peri-implant diseases. The imbalance between the bacterial biofilm and the host response often leads to tissue destruction. Morphological similarities do exist between the gingiva around teeth and that around the implant, but structural differences in these tissues may possibly influence the host response, and be the reason for the destructive and progressive peri-implant tissue loss. New challenges lie in the diagnosis, treatment, and prevention of peri-implant diseases. This overview focuses on whether the diagnostic criteria used to assess the periodontium can also be applied to peri-implant tissues.

INTRODUCTION

Whilst dental implants have been in use for more than thirty years to replace missing teeth,1 it is unfortunate that a new disease has concurrently been created.2 The 11th European Workshop in Periodontology recently reported an alarming and increasing prevalence in peri-implant disease.2,3 The demands of proper diagnosis and treatment and the prevention of peri-implant diseases pose a new challenge in oral health care.4,5 Until such time when consensus is reached regarding the array of clinical parameters used to measure and define peri-implant diseases, many questions regarding the condition remain, such as: 1) do the anatomical differences between teeth and dental implants influence the host immune response? 2)are periodontal diseases and peri-implant diseases different pathological entities? and 3) can the same diagnostic criteria and indices be used for both periodontal diseases and peri-implant diseases?6 The term 'peri-implant disease' was introduced in 2008 at the Sixth European Workshop in Periodontology, and refers to an inflammatory reaction present in the tissues surrounding a functional dental implant.5 The imbalance between the bacterial biofilm and the host response is one of the factors that can cause peri-implant tissue loss.7

The biofilm

In health, millions of commensal bacteria are found in the oral cavity. Regular and effective plaque control practices are necessary to prevent the formation of a biofilm. The formation of a biofilm allows periodontopathic organisms to grow and multiply and this in turn activates the host immune response.8 In nature, most microorganisms live in biofilms, which protects them from the external environment. The biofilm consists of organized microbial communities, made up of a group of bacterial colonizers that irreversibly attach to a substrate in a wet media, with other colonizers being embedded in their extracellular polysaccharide matrix. The nature of the biofilm allows bacteria to evade the natural defense mechanisms.8,9 The outer layers of the subgingival biofilm are in close association with the gingival sulcular epithelium and contain the most pathogenic species. The pathogens secrete end-products, such as lipopolysaccharides, gingipains and proteases that degrade extracellular matrix proteins and trigger the detachment of fibroblasts from the extracellular matrix.8,10 Detachment leads to cell death and subsequent tissue destruction and disease progression.8

The biofilm evokes an inflammatory response, the extent of which is dependent on the bacterial load as well as
on the properties and activation of the immune system.\textsuperscript{8} Commensal oral microbiota exert minimal antigenic reactions and usually exist, when in low numbers, in symbiosis with the host. Pathogens on the other hand, have specific virulence factors that enable them to evade the host inflammatory and immune defense systems, while at the same time triggering chronic inflammatory responses that cause tissue destruction.\textsuperscript{3}

**Immunopathogenesis and peri-implant tissue loss**

Adequate blood supply is needed to bring the cells of the immune system to the site of the bacterial insult. The blood supply around dental implants is not as copious as it is around teeth. Ineffective immune responses may lead to the release of a high number of pro-inflammatory cytokines produced by pathogenic bacteria. The pro-inflammatory cytokines interleukin 1-beta (IL1-\(\beta\)) and tumour necrosis factor alpha (TNF-\(\alpha\)) stimulate fibroblasts, macrophages and epithelial cells to synthesize and release matrix metalloproteinases (MMP's) which in turn cause connective tissue breakdown.\textsuperscript{8} Several mechanisms responsible for bone resorption have been described in the literature,\textsuperscript{8,12-14} and include:

1. IL1-\(\beta\) and TNF-\(\alpha\) cytokines impair the coupling of osteoclasts and osteoblasts. Uncoupling leads to disturbances of bone homeostasis, resulting in a de-differentiation of the osteoclasts, and an increased synthesis of receptor activator of nuclear factor kappa-B ligand (RANKL), which promotes osteoclast activity.\textsuperscript{13,14}

2. Dendritic cells are antigen-presenting cells residing in the epithelium and have the ability to trans-differentiate into osteoclasts.\textsuperscript{12} They also take up bacterial antigens and travel to the lymph nodes to present the antigens to naïve T-lymphocytes. Activated T-lymphocytes mainly produce interferon gamma (IFN-\(\gamma\)) and IL-2, but also RANKL. The activated T-lymphocytes play an important role in the humoral immunity by activating B-lymphocytes into antibody-producing plasma cells.

3. Antibodies aggravate bone destruction by stimulating macrophages to produce excessive amounts of pro-inflammatory cytokines, which in turn stimulates osteoclast recruitment.\textsuperscript{8}

**Are normal plaque control measures effective for all implant designs?**

A dental implant, like a tooth, presents a special challenge to the immune system as it penetrates the basila lamina of the oral epithelium that has its origin from the ectodermal germ layer. If a foreign object interrupts this epithelial integrity, the ideal reaction would expel the object to restore the epithelial continuity. Fortunately, the marginal gingiva is specifically adapted as a zone of tolerance for the penetration of the ectoderm. This soft-tissue attachment around both teeth and dental implants has a similar keratinized oral epithelium that is continuous with the non-keratinized sulcular epithelium. The epithelial and connective tissue apparatus provides a biological seal between the dental implant and the peri-implant soft tissues, or between the natural tooth and the gingival tissues.\textsuperscript{8,15,16} Although the peri-implant soft-tissue barrier has morphological similarities to the gingiva around teeth, structural differences between periodontitis- and peri-implant-lesions may influence the host response.\textsuperscript{17} Does the decreased blood supply around dental implants lead to a compromised immune response? Does the compromised immune response allow pathogens to multiply and cause even more tissue destruction? Can findings obtained from using periodontal indices around dental implants be used as reliable indicators of peri-implant tissue health?\textsuperscript{16} These are questions that still require answers.

**Periodontal indices used as reliable indicators of peri-implant tissue health**

Peri-implant mucositis was first defined as a reversible inflammatory response of the peri-implant soft tissue without any loss of supporting bone around a dental implant.\textsuperscript{18,19} Consensus statements regard peri-implant mucositis and gingivitis as similar entities, with similar clinical findings. The Seventh European Workshop in Periodontology proposed a diagnosis of peri-implant mucositis when gentle probing (0.25 N) of peri-implant tissues elicits bleeding.\textsuperscript{17} Peri-implantitis differs from peri-implant mucositis, in that it includes the loss of supporting bone surrounding a dental implant, as originally defined by the Sixth European Workshop in Periodontology.\textsuperscript{19} During the next Workshop (Seventh), this definition was revised to include changes in the levels of crestal bone over time, as well as bleeding on probing with or without a deepening of probing pocket depth.\textsuperscript{17}

Diminished inflammatory signs (redness, heat, pain, swelling and loss of function) in peri-implant disease (Figure 1) bring into question the clinical parameters proposed by several consensus groups. We know that distinct anatomical differences exist between the tissues surrounding teeth and dental implants. Peri-implant connective tissue resembles scar-like tissue as it contains a high number of collagen fibers and low numbers of fibroblasts and vascular structures. The resulting decrease in blood supply, and a lack of the vascular plexus in the peri-implant tissues, make the tissues more susceptible to bacterial insult, while also showing fewer signs of inflammation.\textsuperscript{20,21}

![Figure 1: Occlusal view of an implant-supported prosthesis in the 25 area. Lack of inflammation is a predictor for healthy peri-implant tissues.](image-url)
a) Clinical probing depth
Although probing is claimed to be essential for the diagnosis of peri-implant disease, the reliability of probing depth is currently being questioned. A tooth site is considered to have periodontitis when there is a probing depth of 4mm or more, together with fibre attachment loss to the tooth surface. As result of connective tissue and/or bone destruction, the epithelial attachment migrates apically. When probing is done around a natural tooth under these circumstances, the tip of the probe penetrates deeper than the average 3mm. There is no connective tissue fibre attachment around a dental implant, therefore, can the diagnostic criteria used to assess the periodontium around teeth also be applied to peri-implant tissues? The poor diagnostic value of probing depths to diagnose peri-implant diseases contradicts the recommendations currently suggested by Periodontal Societies world-wide. There are no reports in the literature that demonstrate probing depths >4mm as being outside the normal anatomic variation when it comes to dental implants. Deeper probing depths are accepted when dental implants are placed deeper subcrestally, or when mucosal tissues are thicker or more scalloped. More human studies are needed to determine what significance increasing probing depths over time have on peri-implant tissues. Additional factors such as implant hardware, surgical technique, or prostheses which may affect probing depth measurements, should also be considered.

b) Bleeding on probing
While the presence of bleeding on probing is a poor predictor of future disease progression at a periodontal site, the absence of bleeding is a good predictor of future stability. There are other factors which can cause bleeding upon probing including: excessive probing force, incorrect probe angulation, and increased probe tip diameters. The vasoconstrictive effects of smoking can mask sites with inflammation and may show less bleeding on probing. According to consensus statements of the Sixth and Seventh European Workshops in Periodontology, the presence of bleeding on probing may be used as a predictor of loss of tissue support when dealing with dental implants. Studies quoted in these consensus statements should be interpreted with caution as some have missing baseline data, for example, crestal bone level changes were not recorded at all times, and incorrect disease definitions were applied. Thus there is poor evidence to recommend bleeding on probing as a useful clinical parameter for predicting future peri-implant attachment loss. Bleeding on probing does not always indicate the presence of acute inflammation in peri-implant mucosa, but may rather reflect the nature of the scar tissue-implant interface.

c) Cresal bone level changes
During the Eighth European Workshop in Periodontology, it was clearly stated that the development of peri-implant disease could only be recognized and followed over subsequent examinations. In the presence of any clinical change, whether bleeding on probing or increased probing depth with or without suppuration, a radiograph might be necessary to evaluate possible bone loss. This presents a problem when no baseline or previous radiographs are present for comparison. Radiographic evaluation of crestal bone levels over time seems to be the most reliable tool to identify those dental implants undergoing continuous bone loss, but one should consider the limitations of two-dimensional images as the true nature and extent of tissue destruction are not fully revealed.

Proposed criteria of acceptable bone loss of 1.5 mm during the first year of loading, and 0.2 mm annually thereafter, are still widely accepted by the scientific community. Significant changes in implant treatment protocols have occurred, ranging from using machined-surfaced implants and mainly restoring the edentulous jaw, to current protocols involving surface-enhanced implants restoring single missing teeth. Many other non-infectious factors may also contribute to early bone loss. The reader is referred to a published article for a more comprehensive review on this topic. The amount of bone remodeling depends on implant hardware, surgical technique, prosthesis design, and patient factors. The presence or absence of a dental implant-abutment interface that may harbor bacteria plays an important role in peri-implant health. A chronic presence of inflammatory-cell infiltrate is found whenever a micro-gap is present (Figures 2a and 2b). Histological differences exist between periodontitis- and peri-implantitis lesions.

Figure 2a: A micro-focus cone beam tomography image showing the microgap present at the implant-abutment interface.

Figure 2b: Extensive plaque accumulation is noticed when the implant crown is removed. The presence of extensive biofilms is commonly encountered in implant systems with large microgaps.
The treatment of peri-implant diseases

Different etiologies are associated with peri-implant bone loss. Infection within the peri-implant tissues is only one of the causes that may be responsible for peri-implant tissue loss. Peri-implant diseases caused by excess cement or by incorrect surgical protocols can surely not be regarded as a disease process similar to a biofilm-induced peri-implantitis. A lack of a standardized classification system to differentiate between peri-implant diseases creates confusion when interpreting results of studies evaluating prevalence and treatment outcomes. A classification system based on etiology has recently been proposed to differentiate between pathologic (bacterial biofilm) and non-pathologic conditions (residual cement, impacted food debris, buccal implant placement, overheating of the alveolar bone during surgical placement, etc.) that can cause peri-implant diseases. It is important to correctly diagnose peri-implant disease, as the response to treatment varies widely according to the causative factor.

The goal of peri-implant therapy should also be clearly defined. The use of non-validated end points, such as probing depths of ≥4mm and bleeding on probing, may be more harmful than beneficial, as this may lead to incorrect diagnoses and unwarranted treatment recommendations. Peri-implant diseases, irrespective of their cause, are complications that require treatment. Whilst current evidence is not yet sufficient to prove a causal relationship between oral health and general health, the treatment of peri-implant diseases remains important.

Lack of treatment not only affects implant survival, but may also pose risks of systemic inflammation which may influence the overall general health of the patient.

CONCLUSION

Peri-implant disease is a collective term used to describe chronic inflammatory processes in the tissues surrounding an intra-oral dental implant. There seems to be confusion in the literature regarding etiological factors responsible for the development of peri-implant diseases. A final diagnosis can only be made once the etiological factor has been identified. One cannot apply the same treatment protocol for teeth with periodontal disease to implants with peri-implant disease. Differences in the structural anatomy between teeth and dental implants exist and should be considered whenever treatment is planned. Perhaps the attention should shift away from the diagnosis and treatment of peri-implant diseases, and rather focus more on their prevention. This could be more beneficial, economical, and more successful. Adequate treatment planning and execution may lead to the successful prevention of peri-implant diseases.

References:


Maxillofacial radiology case 162

Below are images of Peripheral Nerve Sheath Tumours (PNST) that presented in lower jaws of various patients that presented or referred to the Oral Health Science Centre of the Faculty of Dentistry, University of the Western Cape over the past 30 years. What are the important radiological features and what is your diagnosis?

**INTERPRETATION**

**Figure 1** is a cropped pantomograph of a 25 year old female who presented with a history of pain and a slight asymmetry at the angle of the lower right mandible. Radiographically a well-defined corticated radiolucency is discernible in the 48 region. A histological diagnosis of a neurofibroma was made. A solitary neurofibroma occurs in an individual who does not have hereditary neurofibromatosis. The tumour is most often seen in the body of the mandible, sometimes in connection with the mental foramen. It is slow growing but may expand the cortical plate. **Figure 2** is a cropped oblique lateral radiograph of a 51 year old male who presented with a slow growing painless lesion in the body of the left mandible. The lesion has a multilocular radiolucent appearance causing expansion of the mandible. A histological diagnosis of a benign Schwannoma was made. Most of the cases of Schwannoma or neurilemmomas present in the alveolar canal. They can occur at any age but are most common between 30 and 50 years. It is a benign tumour arising from and consisting solely of Schwann cells. Comparisons between Schwannomas and neurofibromas are frequent, but these tumours can be readily separated clinically and usually histologically. Schwannomas occur most commonly in the head and neck area where the tongue and floor of mouth are the most common sites. Because Schwannomas are painless and slow growing, they often reach sizes in excess of 5 cm x 5 cm before treatment is sought. **Figure 3** is a cropped pantomograph of a 42 year old male presenting with pain in the 33 region (yellow arrow), with a history of being assaulted six months previously. The pantomograph shows a multilocular radiolucency with well demarcated borders. A histological diagnosis of a traumatic neuroma was made. Most intrabony traumatic neuromas are seen in the mandible as a result of injury to the inferior alveolar nerve caused by a fracture, extraction of an impacted tooth or by orthognathic surgery. On excision of a traumatic neuroma, healing is usually uneventful. **Figures 4, 5 & 6** are images of a 51 year old male patient with a history of pain in the left mandible, problems on opening his jaw and also paraesthesia of the left lower jaw. Figure 4 shows enlargement of the inferior alveolar canal and the axial CT image (Fig.5) shows perforation of the cortex in two places (red arrows). Figure 6, taken a few months after extraction of the posterior teeth and commencement of radiation therapy, shows further enlargement of the canal with irregular ragged borders and destruction of the cortex. A histological diagnosis of a malignant Schwannoma was made. Malignant Schwannoma is an uncommon neoplasm, consisting predominantly of spindle cell growth. The tumour is extremely rare in the maxillofacial region. The diagnosis of the tumour is difficult, because the histopathologic appearance of a Schwannoma is often quite similar to that of other types of sarcomas showing spindle cell growth, such as fibrosarcoma and leiomyosarcoma.

**References**

The aim of this paper is to provide a broad overview of the notion and basic theory of autonomy, with specific focus on its definition and distinctive concepts, its importance and value. Case examples are used to illustrate the concepts.

DEFINITION(S)
The evolution of the concept of autonomy can be traced back to ancient Greece, a period in which cities defended the ideas of sovereignty and freedom from interference by foreign powers. Hence, autonomy implied self-rule, self-determination and self-ownership. A direct translation of the word autonomy is self rule, from autonomia (n.), and autonomos, (adj.), autos – self and nomos – rule. The modern day concept addresses personal or individual autonomy insofar as the agent may elect to act, or not to act, according to specified prescribed standards, norms or rules (which may have neutral value or be value laden). It is generally accepted that autonomy is that condition when an agent may determine the conception, the articulation and the execution of concepts, ideas and actions for him or her –self.

DISTINCTIVE CONCEPTS OF AUTONOMY
Despite agreement on the basic precepts, several theories of autonomy have emerged over time, under the influence of law, politics, philosophy and religious precepts. Consequently, ‘autonomy’ has different connotations, unevenly understood and applied in a variety of ways. At root level, autonomy means having the capacity to self-govern, which is the ability to act independently, responsibly and with conviction. This concept of autonomy relies on the agency of a moral being to exercise his/her own decisions about his/her being. Legally, the agency of an individual or capacity for self-rule is concerned with mental competence and cognitive capability to make decision at a particular time, hence legal age is used as a proxy for mental and cognitive capacity. This legal threshold fails to acknowledge autonomy as a continuum, beginning with an agent without capacity until full capacity is reached, which can be achieved at different times and to different degrees. Furthermore, this mental capacity can attenuate or be lost even after reaching the threshold. For example, due to deterioration of the brain, an adult could lose moral agency or the ability to exercise reasonable decision-making.

Influenced by Western thought, autonomy refers to the entitlements and rights, the liberties and freedom to make decisions for oneself without interference. However, having the freedom to self-govern does not necessarily mean that the agent will simultaneously have the capacity and the opportunity to exercise the right of self-rule. For example, family position and status can compromise or improve one’s ability to self-determine. Philosophically, the concept of autonomy is idealized beyond capacities and sets of rights. According to this framework, the goal is to achieve a state of fully developed autonomy characterized by settled dispositions and the skills to self-govern. Individuals with these levels of development are less likely to be affected by chance, contingency or weakness of will in exercising self-rule.

To exemplify these concepts, imagine Mrs. Sono (49 years), a loyal patient of over twenty years at Dr Matsho’s private rooms. During her recent dental visit, she courteously suggested to the locum dentist that “Dr, whatever treatment you plan to do, you don’t have to ask me for permission. Dr Matsho treated me well all the time and I trust that you will do the same since you work for him.” Mrs Sono can be said to have relinquished her autonomy, by giving up her capacity to determine the course of her dental treatment. This does not, however, mean that she lacks the capacity or the legal right to do so. On the contrary she decisively exercised her autonomy to abstain from making any choices related to her care.

Now envision John, a 25-year-old prisoner, who urgently needs root canal treatment, which is unfortunately unavailable in the prison oral health system. The prison authorities organized with nearby facilities in order to provide the preferred treatment, failing which dental extractions would be performed in the prison facility to relieve his symptoms. In John’s case autonomy is constrained by the structural and operational limitations of the prison health facility. While he has the capacity to make an autonomous choice in deciding the preferred treatment, the opportunities and conditions to realize his choice or to self-govern are structurally limited.
Mary, a responsible 15 year old, trusted by her parents and teachers for being thoughtful and rational in decision making, presented at your dental office requesting tooth whitening even though it was contraindicated in your expert opinion. She insisted it was for necessary for her to look prettier, oblivious to associated side effects. Mary’s case elucidates the concept of developing autonomy. Because of her young age and limited exposure and life experience, she has not developed adequate levels of autonomy. She does not lack the capacity to self-determine; her capacity is merely limited and constrained by external factors.

The contrary case is about Paul, a 25 years old chronic user and addict to marijuana, alcohol and drugs for over 10 years. He recently completed a three month rehabilitation program and has not used drugs in over seven months. On his visit to your dental practice, you observe the worst oral hygiene ever. Upon questioning Paul, he said, "Doc, all these teeth don’t matter to me, I want to take them all out and buy myself a brand new set of false teeth instead." Paul represents an agent with under-developed autonomy. Despite having the legal right to make decisions; his ability to do so is limited. Unlike Mary, Paul’s incompetence is not attributable to age and experience but to a state of dysfunction related to substance abuse. Whatever decisions Paul make, it remains questionable whether they would have been considered and thought-through or are impulsive and imprudent. Overall Paul lacks the virtues that resemble the ideal autonomous agency.

Finally, Simon collapses in your rooms due to hypoglycemia during routine dental treatment, forcing you to terminate the dental treatment until further notice. Simon is wholly unautonomous, he does not possess the capacity and lacks the legal right and agency for decision making.

These vignettes provide distinctive interpretations of the nature of autonomy, its scope and how it applies under different circumstances, time and context. From a moral point of view, autonomy confers status, which implies that a person is owed respect, dignity and obligations. On legal grounds, autonomy separates personal concerns from the intrusion of the State, in so doing it preserves the sphere of personal sovereignty. At a personal level, autonomy is indicative of a self-creation process through which a person discovers who they are, what they hope for, and want to achieve in their lives, independent of impositions by external interferences.

Our conclusion follows established consensus that autonomy is a morally valuable principle, primarily for its own sake. Kant espouses this assertion in his suggestion that, if we value autonomy we would then ‘act in such a way so as to treat ourselves and others as end and never simply as a means to an end’. Second, autonomy confers instrumental value, as a ‘means’ towards achieving some “end” with intrinsic value. Imagine a patient who places implants in his/her lip to achieve a certain aesthetic appeal, and in the process experiences pain and sepsis and several days of hospitalization. According to the intrinsic view, despite the unfavourability of the choices made, autonomy has to be respected. In this instance autonomy did not result in any value add, but loss. It could therefore be argued from a position of instrumental value that social recognition, aesthetics and looks were intended ends of the process. Therefore this choice had potential benefits, and should be regarded as autonomous.

CONDITIONALITY OF AUTONOMY

The conditions governing autonomy constitute the most contested area in moral and ethical literature. Two conditions are considered essential for autonomy, firstly, liberty or freedom from undue external influences which may enable or interfere with or hinder free decision-making process. Secondly, to be an agency capable of intentional acts, or the competence to comprehend, retain and interpret information, which is finally articulated as a decision reached. However, areas of disagreements remain around what these conditions mean, and whether they are sufficient or necessary.

The scope of this paper is about autonomous choice, rather than focusing on the general capacities of self-determination and governance. Such debates are less helpful in framing a basic theory and understanding of the principle of autonomy. Imagine for example an autonomous person who fails to act accordingly at some point due to temporary cognitive impairment, like depression. Or, take a patient who signs the consent form for a major surgical procedure without reading the document. These two cases highlight the need to construct a theoretical framework to use in evaluating the level of autonomy exercised by autonomous agents.

The Beauchamp and Childress theory of autonomy is premised on the thesis that choices of a competent person are autonomous if they are intentional, and are demonstrative of comprehension and are free from internal or external influences. Accordingly their analysis of autonomy focuses three non-ideal conditions:

i) Intentionality as opposed to incidentality, meaning that a plan has been developed, comprising of series of events with a set outcome in mind. Intentionality does not imply executing plans, often times intentions are wishes.

ii) Comprehension, an act would be judged as autonomous if the situation is adequately understood. Poor communication can severely hinder understanding; other factors that could impede understanding include immaturity, illness and irrationality due to substance abuse etc. Comprehension will vary in degrees and over the passage of time. A person might fully understand at some point in time but may be totally non-comprehending at some other time depending on the context.

iii) Voluntariness and non-control means that the actor is free from undue influence, especially coercion and manipulation.

When evaluating autonomous acts according to this theory of the three conditions, one ought to establish if the act was intentional or not (there are no varying degrees of intentionality). As for comprehension and voluntariness and non-control, the levels will vary to some degree. An individual might be under total control ranging to absolutely none; might fully understand down to lacking the faintest idea. While outright objectivity might be difficult to achieve, a line must be drawn to indicate sufficient or inadequate understanding. Similarly, a measure must be developed indicative of control and non-control. These
thresholds are particularly useful in determining the degree of autonomous choice, and how substantial or not is the decision making in a particular context.

APPLYING THE THEORY IN PRACTICE
Mr. Piet, a 59-year-old man with multiple chronic dental problems consulted your practice, indicating that he had not slept the night before due to severe dental pain. At the time of the dental visit, the pain has subsided, and the patient was requesting anterior gold inlays on asymptomatic but carious 21, 22, 11 and 12. After explaining your findings and the seriousness and urgency of commencing dental treatment, the patient insisted on his gold inlays and threatened to go somewhere else if not assisted immediately. Can we conclude that the patient’s request was autonomous? Based on the three-condition theory, a decision is autonomous if it is intentional, demonstrates an understanding of the issues at stake and is voluntary. Mr. Piet has certainly given his decision some thought, he saved huge amount of resources for this treatment, it is hence very unlikely that the decision to place gold inlays was incidental. Therefore, we could conclude that there was substantial intention on the part of the patient. Mr. Piet could be deemed competent, in that he understood his oral health status and the need to urgently have dental treatment. Despite having discussed the pros and cons of his condition, Piet refused appropriate care, and threatened to go elsewhere for gold inlays. It is plausible that Mr. Piet could have experienced some level of coercion from the dentist. It is also possible that Mr. Piet understood that request was, at that point in time, difficult to meet, hence his threat to seek care elsewhere. The refusal by the dentist to provide gold inlays cannot be interpreted as undue influence, but good and ethical clinical practice. If the patient’s oral hygiene was optimal, perhaps a different argument could be made as to why inlays were refused. It is therefore appropriate to conclude that to a substantial degree, Mr. Piet’s decision was autonomous. Autonomous decision by patients does not mean the clinician should accept and undertake clinical procedure. It simply implies that the patient is cognisant and is able to determine for himself how they should be treated. It is imperative for clinicians to respect the patients position or state.

IMPLICATIONS FOR PRACTITIONERS
Some authors regard autonomy as a *prima facie* and paramount principle in ethical debate. For this reason, it is critical that the patient’s autonomous status or competence be objectively established before any clinical intervention is made. Often time clinicians are too concerned about the benefits and harms associated with an intervention and disregard the centrality of autonomy in joint decision-making. The cases presented above highlight the need for practitioners to firstly consider the impact of individual principles in the case under review. Secondly, practitioners should identify any logical incompatibility of ethical principles and the clinical choices associated with each principle. Prior to making ethical decisions, it is critical that the contribution of each principle and the associated choices be extrapolated to the resolution of the ethical dilemmas. Clinical dilemmas are becoming more complex in recent times, it is thus imperative for practitioners to develop a framework to appraise and evaluate such situations in order to reach ethically and morally reasonable, sound clinical decisions.

References
7. Gillon R. Ethics needs principles—four can encompass the rest—and respect for autonomy should be “first among equals.” Journal of Medical Ethics 2003;29 (5):207-12.
Clinicians are frequently challenged on the management of patients with periodontitis of varying extent and severity. Treatment options range from scaling and root planing (SRP) to SRP with adjunctive treatments, to surgical interventions. In 2011, the Council on Scientific Affairs of the American Dental Association (ADA) resolved to develop from a systematic review of the literature a clinical practice guideline for the nonsurgical treatment of chronic periodontitis with SRP with or without adjuncts. Clinical attachment level (CAL) was the sole outcome on which the reviewers compared the various treatments.

The study evaluated the following professionally applied or prescribed medical adjuncts: locally applied antimicrobials (chlorhexidine chips, doxycycline hyclate [DH] gel, and minocycline microspheres), nonsurgical use of lasers (diode, both photodynamic therapy [PDT] and non-PDT; neodymium:yttrium-aluminum-garnet [Nd:YAG]; and erbium), systemic antimicrobials, and systemic subantimicrobial-dose doxycycline (SDD). They also considered systemic antimicrobials and systemic SDD separately because the latter appears to inhibit mammalian collagenase activity (matrix metalloproteinase 8) and not function as an antibiotic. The review team did not consider experimental adjuncts, adjuncts not currently available in the United States, nonprescription (over-the-counter) adjuncts, or surgical treatments.

The following clinical questions were reviewed:

• **Question 1:** In patients with chronic periodontitis, does SRP (hand or ultrasonic), when compared with no treatment, supragingival scaling and polish (prophylaxis), or debridement, result in greater improvement of CAL?

• **Question 2:** In patients with chronic periodontitis, does the use of adjuncts such as local antibiotics or antimicrobials, systemic antibiotics, combinations of local and systemic antibiotics, agents for biomodification, host modulation or nonsurgical lasers, result in a greater improvement of CAL, compared with that achieved with SRP alone?

**METHODS**

A comprehensive search strategy was developed and two electronic databases (PubMed and Embase) and the reference section of selected systematic reviews were screened to identify missed references. The search was first conducted in October 2012 and updated in July 2014. Randomized controlled trials (both parallel-arm and split-mouth studies) were included if they were published after 1960, written in English, and reported changes in CAL at least six months after randomization. Clinical attachment level (CAL) was chosen as a primary outcome because probing depth changes fail to capture the effect of nonsurgical treatment. Excluded were studies of aggressive periodontitis, as well as studies in which the adjunct was administered more than one week after SRP or was reapplied to progressing (worsening) tooth sites.

The authors independently reviewed and extracted the relevant data from included studies and appraised each study with the Cochrane Risk of Bias Tool. In assessing the effectiveness of SRP alone (Question 1), the reviewers compared mean change in CAL between
SRP and controls. To assess adjuncts (Question 2), the mean changes between groups receiving SRP and those receiving SRP plus an adjunct were compared. Meta-analyses was done by using the random effects model. Overall results for each treatment or adjunct was reviewed and the level of certainty in the evidence was assessed as high, moderate, or low as shown in Table 1 below.

SUMMARY OF INTERVENTIONS, STATISTICAL SIGNIFICANCE (P< 0.05 OR P > 0.05) AND STRENGTH OF EVIDENCE.

Scaling and root planing (SRP) versus no treatment
Eleven studies met the inclusion criteria for reporting the effect of SRP compared with no treatment, supragingival scaling, or debridement, on chronic periodontitis. Compared with no treatment, SRP treatment resulted in an average of 0.49-millimeter gain in CAL (95% confidence interval [CI], 0.36-0.62 mm; p <0.05). Overall level of certainty in the evidence was judged to be moderate.

Systemic subantimicrobial-dose doxycycline (SDD) and SRP
SDD (Periostat, CollaGenex Pharmaceuticals) is considered a host-modulating agent. Specifically, it inhibits the collagen-degrading enzymes of the host. Compared with SRP alone, SRP plus SDD resulted in a 0.35-mm mean gain in CAL (95% CI, 0.15-0.56; p <0.05).

Overall level of certainty in the evidence was judged to be moderate.

Systemic antimicrobials and SRP
Twenty-four studies met the inclusion criteria for reporting the effect of SRP plus a systemic antimicrobial versus SRP alone. All were parallel-group trials. Compared with SRP alone, SRP plus systemic antimicrobials resulted in a 0.35-mm mean gain in CAL (95% CI, 0.20-0.51; p < 0.05). Overall level of certainty in the evidence was judged to be moderate.

Locally delivered antimicrobials and SRP
Chlorhexidine chips and SRP
Compared with SRP alone, SRP plus chlorhexidine chips resulted in a 0.40-mm mean gain in CAL (95% CI, 0.24-0.56; p <0.05). Overall level of certainty in the evidence was judged to be moderate.

Doxycycline Hyclate (DH) gel and SRP
Three small studies met the inclusion criteria for reporting the effect of SRP plus the local delivery of DH gel compared with SRP alone. Two were split-mouth studies and one study was a parallel-group trial. Compared with SRP alone, SRP plus DH gel resulted in a 0.64-mm mean gain in CAL (95% CI, 0.00-1.28; p> 0.05). Overall level of certainty in the evidence was judged to be low.

Table 1: Level of certainty of the evidence

<table>
<thead>
<tr>
<th>Level of certainty in effect estimate</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>The body of evidence usually includes consistent results from well-designed, well-conducted studies in representative populations. This conclusion is unlikely to be affected strongly by the results of future studies. This statement is established strongly by the best available evidence.</td>
</tr>
<tr>
<td>Moderate</td>
<td>As more information becomes available, the magnitude or direction of the observed effect could change, and this change could be large enough to alter the conclusion. This statement is based on preliminary determinations from the current best available evidence, but confidence in the estimate is constrained by one or more factors, such as the following:</td>
</tr>
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<td></td>
<td>- Limited number or size of studies</td>
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<td></td>
<td>- Plausible bias that raises some doubt about the results</td>
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<td></td>
<td>- Inconsistency of findings across individual studies</td>
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<td></td>
<td>- Imprecision in the summary estimate</td>
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<td></td>
<td>- Limited applicability because of the populations of interest</td>
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<td></td>
<td>- Evidence of publication bias</td>
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<td>- Lack of coherence in the chain of evidence</td>
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<tr>
<td>Low</td>
<td>More information could allow a reliable estimation of effects on health outcomes. The available evidence is insufficient to support the statement, or the statement is based on extrapolation from the best available evidence. The evidence is judged to be insufficient, or the reliability of estimated effects is limited by factors such as the following:</td>
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<td>- Limited number or size of studies</td>
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<td>- Plausible bias that seriously weakens confidence in the results</td>
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<td>- Inconsistency of findings across individual studies</td>
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<td>- Imprecision in the summary estimate</td>
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<td>- Gaps in the chain of evidence</td>
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<td>- Findings not applicable to the populations of interest</td>
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<td></td>
<td>- Evidence of publication bias</td>
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<tr>
<td></td>
<td>- Lack of information on important health outcomes</td>
</tr>
</tbody>
</table>
**Minocycline microspheres and SRP**
Compared with SRP alone, SRP plus minocycline microspheres resulted in a 0.24-mm mean gain in CAL (95% CI, −0.06 to 0.55; p > 0.05). Overall level of certainty in the evidence was judged to be low.

**Nonsurgical use of lasers and SRP**
Several types of lasers are used nonsurgically as adjunctive treatments with SRP. The lasers are categorized primarily by the wavelength of the emitted light. Five categories of lasers are included and described here.

**PDT (photodynamic therapy) diode laser and SRP**
Compared with SRP alone, SRP plus PDT diode laser resulted in a 0.53-mm mean gain in CAL (95% CI, 0.06-1.00; p < 0.05). Overall level of certainty in the evidence was judged to be moderate.

**Non-PDT diode laser and SRP**
Compared with SRP alone, SRP plus non-PDT diode laser resulted in a 0.21-mm mean gain in CAL (95% CI, −0.23 to 0.64; p >0.05). Overall level of certainty in the evidence was judged to be low.

**Nd:YAG laser and SRP**
Compared with SRP alone, SRP plus Nd:YAG laser resulted in a 0.41-mm mean gain in CAL (95% CI, −0.12 to 0.94; p>0.05). Overall level of certainty in the evidence was judged to be low.

**Erbium laser and SRP**
Compared with SRP alone, SRP plus erbium laser resulted in a 0.18-mm mean gain in CAL (95% CI, −0.63 to 0.98; p>0.05). Overall level of certainty in the evidence was judged to be low.

**Summary statements on nonsurgical use of lasers**
Unlike other instruments, lasers have no defined and accepted protocols for standard usage. Because every operator determines his or her own protocol on the basis of anecdotal rules or experiences, the potential for adverse events to the tooth and patient is higher than it is with other local delivery systems. Also, laser wavelengths vary, affecting the hard and soft tissues differently, and making comparisons between lasers unpredictable and often incorrect. Common protocols are needed for each laser used in the nonsurgical therapy of chronic periodontitis to allow for repeatable results and comparisons among studies in the literature. The wide ranges found in the few studies considered for CAL gain or loss demonstrate the need for larger sample sizes and for additional studies, properly to evaluate the potential benefits of laser use as an adjunct to SRP. At this time, on the basis of the criteria set in this systematic review evidence-based literature, there is in fact insufficient evidence for any laser wavelength except that of the PDT diode lasers to enable accurate definition of the benefits of adjunctive nonsurgical therapy of periodontitis.

**CONCLUSIONS**
On average, treatment of chronic periodontitis with SRP was associated with a 0.5-mm improvement in CAL against no treatment at a moderate level of certainty.

The reviewers found benefits in four adjunctive therapies as compared with SRP alone: systemic SDD, systemic antimicrobials, chlorhexidine chips, and PDT with a diode laser at a moderate level of certainty. They found a low level of certainty on the benefits of the other five adjunctive therapies. Combinations of SRP with these assorted adjuncts resulted in a range of average CAL improvements between 0.2 and 0.6 mm over SRP alone.

**IMPLICATIONS FOR PRACTICE**
This high quality review, which is used as an ADA (American Dental Association) guideline, should serve as an important evidence base for clinicians considering one or more of the above interventions.

**Reference**
**GENERAL**

*Mapping oral and oropharyngeal cancer in South Africa.*

1. Which are the most common pre-malignant lesions in the oral cavity?
   a. Leukoplakia, Lichen Planus, erythroplakia
   b. Leukoplakia, erythroplakia and Oral submucous fibrosis
   c. Candidiasis, Oral submucous fibrosis, erythroplakia
   d. Oral submucous fibrosis, leukoplakia, Lupus erythematosus

**TRUE or FALSE**

2. This study found that that smoking and alcohol consumption were the aetiological factors most frequently associated with Oral squamous cell carcinoma.
   a. True
   b. False

3. Identify the correct answer.
   What is the gold standard test for the diagnosis of oral cancer lesions?
   a. Exfoliative cytology
   b. Biopsy
   c. Vital staining
   d. Autofluorescence

4. Identify the correct statement.
   Oral and oropharyngeal cancer...
   a. only affects patients over 50 years of age.
   b. globally, has not been associated with low socio-economic status.
   c. in general has a higher prevalence in males.
   d. has low morbidity and mortality rates.

**The in vitro effect of leukocyte- and platelet-rich fibrin (L-PRF) and cross-linked hyaluronic acid on fibroblast viability and proliferation.**

**TRUE or FALSE**

5. Since hyaluronic acid causes inflammation, this study investigated whether the acid would offset the influence of LRPF and result in a decrease in fibroblast activity.
   a. True
   b. False

6. The MTT test (an assay using 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) evaluates cell viability and cell proliferation.
   a. True
   b. False

7. Identify the correct statement
   The combination of L-PRF and cHA:
   a. seems to provide an initial considerable stimulus to cellular growth which reduces over time.
   b. seems to provide no further advantage when compared with using either of the materials on their own.
   c. seems to provide a delayed stimulus to cellular growth which is seen only after a few days.

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**Graduate perceptions on dental training to inform dental curriculum from an occupational health perspective**

8. Identify the incorrect statement
   Peri-Implant disease:
   a. may be diagnosed using precisely the criteria applied to the diagnosis of periodontitis.
   b. was defined as a disease entity in 2008.
   c. refers to an inflammatory reaction present in the tissues surrounding a functional dental implant.
   d. may be caused by an imbalance between the bacterial biofilm and the host response.

9. Identify the incorrect statement
   Inadequate immune response around implants...
   a. is caused by poor blood supply.
   b. allows pathogenic bacteria to produce pro-inflammatory cytokines.
   c. leads to cytokine stimulation of fibroblasts to release metalloproteinases which cause tissue breakdown.
   d. leads to enhanced osteoblast activity to produce bone to counter low levels of oxygen.

**Dental Therapy Student cohorts: Trends in enrolment and progress at a South African University.**

10. Identify the incorrect statement
    Dental therapists practice independently...
    a. since facilitating legislation was passed in October 1995.
    b. providing holistic oral and dental care of patients.
    c. functioning in preventive, promotive and rehabilitative health.
    d. and contribute on primary, secondary and tertiary levels.

**TRUE or FALSE**

11. A little less than five hundred dental therapists are currently registered with the Health Professions Council of South Africa.
    a. True
    b. False

12. The current dental therapist to population ratio in South Africa is 0.13 per 10,000.
    a. True
    b. False

13. Dental therapists are trained at three dental schools.
    a. True
    b. False
Maxillo-facial and Oral Radiography 162

TRUE or FALSE
14. Neurofibroma appears only in a patient who has hereditary neurofibromatosis.
   a. True
   b. False

15. Traumatic neuroma appears in patients due to trauma of the inferior alveolar nerve.
   a. True
   b. False

Clinical Windows
ADA: American Dental Association
CAL: clinical attachment level
DH: doxycycline hyclate
SDD: subantimicrobial-dose doxycycline
SRP: scaling and root planing

TRUE or FALSE
16. In the ADA review, compared with no treatment, SRP treatment resulted in a significant 0.49-millimeter gain in CAL (P< 0.05).
   a. True
   b. False

17. In the ADA review, compared with SRP alone, SRP plus SDD resulted in a non-significant 0.35-mm mean gain in CAL (p> 0.05)
   a. True
   b. False

18. In the ADA review, compared with SRP alone, SRP plus chlorhexidine chips resulted in a 0.40-mm mean gain in CAL (p< 0.05)
   a. True
   b. False

19. In the ADA review, compared with SRP alone, SRP plus DH gel resulted in a 0.64-mm mean gain in CAL (p < 0.05)
   a. True
   b. False

20. In the ADA review, compared with SRP alone, SRP plus minocycline microspheres resulted in a 0.24mm mean gain in CAL
   a. True
   b. False

ETHICAL
Understanding of the principle of Autonomy

21. Identify the correct answer
   The ethical concept of autonomy means:
   a. having the conviction to act irrespective of moral considerations.
   b. being able to act by rejecting all reasonable advice.
   c. having the capacity to self-govern, which is the ability to act independently, responsibly and with conviction.
   d. allowing events to take their own course.

22. Identify the correct answer
   The moral and ethical literature regarding the conditions governing autonomy is...
   a. clearly in agreement.
   b. disputatious.
   c. still being debated.
   d. partly but not entirely in agreement.

TRUE or FALSE
23. A patient who relinquished her autonomy, by giving up her capacity to determine the course of her dental treatment, lacks the capacity or the legal right to make decisions.
   a. True
   b. False

24. Structural and operational limitations can adversely impact the autonomy of a patient.
   a. True
   b. False

25. Identify the correct answer
   It is imperative that the patient’s autonomous status or competence be accurately established,
   a. immediately after the first visit.
   b. before the account is presented.
   c. before the patient is accepted into the practice.
   d. before any clinical intervention is made.
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