RESEARCH

204 Planning for Financially Independent Retirement

209 An assessment of the accuracy of a panoramic radiograph as compared with cone-beam tomography in TMJ imaging

213 Impacted mandibular third molars: the efficacy of prophylactic antibiotics and chlorhexidine mouthwash in preventing postoperative infections

There are some 1650 species of gecko worldwide. Their ability to walk on vertical surfaces is afforded by de Wals forces (see Editorial SADJ February 2015). Their dentition is polyphyodont and is truly ‘poly’ there are some 100 teeth, each being replaced every three to four months! And that despite the teeth being ankylosed to the inner surface of the jaw bones!

South African examples
- Common house Gecko: Hemidactylus frenatus
- Spotted Thick toed Gecko: Pachdactylus masculatus

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Most people would see this as a straight line. The rare ones have the ability to turn it into a heartbeat.

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contents

editorial
202
at sixes and sevens - WG Evans

communicue
203
SADA Communique - KC Makhubele

research
204
Planning for Financially Independent Retirement
- L Snyman, S E van der Berg-Cloete, J G White
209
An assessment of the accuracy of a panoramic radiograph as compared with cone-beam tomography in TMJ imaging
- V Soni, B Buch
213
Impacted mandibular third molars: the efficacy of prophylactic antibiotics and chlorhexidine mouthwash in preventing postoperative infections - P Goppea, E Rikhotsko

case report
220
Electro-surgical management of a peripheral ossifying fibroma
- N Singh, V Kumar R, S Savita

Case book
224
Oral medicine case book 74: Marijuana-induced Oral Leukoplakia
- D Temilola, H Holmes, S Mulder Van Staden, A Afrogheh

radiology case
227
Maxillo-facial radiology case 151 - CJ Nortjé

forensic odontology
228
Forensic dentistry case book 9: The “bite mark” that caused confusion
- H Bernitz, BA Kloppers

ethics
230
Practicing beyond your expertise - Part 10. Who’s to blame, who’s to name? - LM Sykes, Z Vally, WG Evans

clinical window
234
What’s new for the clinician? - V Yengopal

Continuous Professional Development
238
CPD questionnaire

Business Directory
240
Listing of dental products and service providers

SADA Congress 2017
242
Congress Plenary programme
243
Congress Specialists programme

classifieds
244
www.sada.co.za - Smalls advertising placement procedure and rules

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At sixes and sevens

Let’s take a cue from the Communique released by our Association CEO and published in the May issue of the Journal:

- National Health Insurance planning staggers along, with recent decisions appearing to reverse previous policy, vide the revised role envisaged of the Medical Aid Schemes, now being wooed to work with the State in operating the NHI and in covering conditions originally reserved for NHI only.
- Dental Assistants obliged to register and the Professional Board for Dental Therapy and Oral Hygiene extends the deadlines.
- The Dental Technology Professions Bill introduces denturists, restricts the rights of dentists to choose their technician, limits the options of dental traders to trade feely and…
- Extends the right of technicians to claim directly from Medical Aid Schemes, even when the dentist is not satisfied with the prosthesis.

The phrase “At sixes and sevens” may well encompass these developments. It may be defined as “a state of confusion and disorder or of disagreement between parties” (Phrase Thesaurus). It probably derived from a complicated game of dice which was called “Hazard” in which the riskiest numbers to shoot for were five and six… in French cinque et sìce… easily misinterpreted into English as “six and seven”. Wikipedia lists many examples of the application of the phrase, right from the mid 1380’s, viz Chaucer, Shakespeare, Gilbert and Sullivan amongst others. Topically it may be interesting to note that Harold Macmillan referred to “Six and Seven” when United Kingdom membership of the European Economic Community was first muted in the 1960’s, and how applicable is it right now that the UK is facing Brexit!

The profession may well be entangled in a state of confusion and disorder exemplified by the developments listed by our CEO, a state of Sixes and Sevens, but not yet in chaos! At least not in the usual sense of the word which implies somewhat more than the six and seven dilemma. Nevertheless a wider inspection may lead to a consideration of whether the Theory of Chaos may actually apply. This is an intriguing thought. The Theory is a branch of mathematics which is focused “on the behaviour of dynamical systems which are highly sensitive to initial conditions” (Wikipedia). Chaos Theory is exemplified by the butterfly wing story…the paper presented by Edward Lorenz in 1972 entitled: “Predictability: Does the flap of a butterfly’s wings in Brazil set off a tornado in Texas? Ridiculous of course… until serious consideration is given to the explanations. Essentially it proposes that a small change in the initial condition of the system causes a progressive chain of events which leads to large scale phenomena. The most intriguing aspect of the theory is that it recognizes that chaotic systems are predictable in the short term but then seem to become random. In principle the behaviour of a deterministic system can be predicted… but in a chaos sequence, predictions can hold true for a limited period only. In the prediction of weather, as a convenient example, we may be reasonably accurate in our predictions over a few days forward.. but thereafter there is increasing uncertainty. The systems may be deterministic, in other words, future behaviour is determined by the initial conditions But that does not make them fully predictable.

Lorenz summarised the theory in 1963:

Chaos: When the present determines the future but the approximate present does not approximately determine the future.

Sufficiently confusing? But the ideas are clear a small change now can result in a considerable (if not huge) change later,… and now lets revert to the scenarios mentioned by our CEO and repeated above. The changes envisaged are already radical.. even at this initial stage. If there are any Chaos influences which may affect the outcome, the Association and the Profession will be facing increasingly complex situations. What precisely can we forecast as the long term effect of the professional not being able to determine which technician shall handle his or her cases? How will collusion between Medical Aid Societies and NHI impact on private dental practice? Will the new registered members of the Oral Health Care team come to enjoy greatly extended clinical options? In fact, are we contemplating a situation befuddled and all at SIXES and SEVENS?

The Association will depend upon the full participation of members in dealing with these issues.

Is it not serendipitous that in July we can bring the sixes and the sevens together in a manner which will redound to the enhanced reputation of our Association?…. Mandela Day on 18th July offers the chance for us to celebrate the 67 magical number., he devoted 67 years of his life to the community. Can we offer our 67 minutes, can we contribute to the initiative of the Association? Positive action to minimize Chaos!
SADA Communique

The fires that engulfed Knysna displaced up to 4000 people with some 500 homes destroyed and a tragic toll of loss of life. Some residents are not only battling with the loss of everything they owned, but also with the emotional trauma of the inferno. SADA Head Office with the Western Cape Branch called members practising in the area and a member of staff spent the weekend calling on members to enquire after their safety. Four members most sadly lost their belongings and homes but we are happy to report that of those members who were contacted, the majority were fine. We are appealing to all members to make whatever contributions they can make to assist all those affected by this tragedy.

On a more positive note, the planning and registrations for the SADA 2017 Congress and Exhibition are progressing full steam ahead. It is very encouraging and we are happy to report that Head Office staff began telephone canvassing and surpassed our expectations by confirming in excess of 400 registrants who took advantage of the early bird special. The dental traders and manufacturing fraternity have responded positively to the Congress and have taken up almost all exhibition stands. The international and local speakers have confirmed their attendance and are beginning to book their travel and accommodation. We would request members travelling to Cape Town to make their travel and accommodation arrangements in sufficient time as we are expecting an incredible attendance.

We hope members are using the opportunity provided by the Professional Board of the HPCSA to permit unregistered and unqualified dental assistants to register, or to write Board examinations to secure their registration. Members should by now have received two communiques with all information, forms and study guides to assist them and their employees.

The Dental Practice Committee has begun its project on determining Relative Value Units for dental procedures contained in the SADA Dental Codes for the profession. A Steering Committee has been set up to oversee this project with appointed consultants. We are indebted to the specialist societies affiliated to the Association whose representatives are serving on the Committee to advise on their respective specialist procedures.

An appeal is made to members and Branches to contribute to the SADA Benevolent Fund which is assisting members and their families who have fallen on hard times. The funds are presently under considerable strain and we anticipate that beneficiaries will be assisted only for the next two to three years.

KC Makhubule - SADA CEO

Reproduced is the Communique circulated by Head Office.

SADA Mandela Day Campaign 2017 - SADA “67 Teeth” of Kindness

"Laughter is the sun that drives winter from the human face." - Victor Hugo

Good day SADA Members and Supporters

I trust this finds you all well. As we know we are about to enter into the heart of winter which can be so brutal and unkind to so many of our fellow South Africans. As we approach Nelson Mandela Day, we are reminded the best rewards in life often come from the warmth of our love and care for those around us.

As employees and members of the South African Dental Association, let us bring more than just a beautiful smile to the many lives we touch by donating a blanket and a warm cup of soup to show love and support to the charities of our choice.

We at Head Office urge each branch to please ask its team and members to each give donations of blankets, non-perishables and all things warm and lovely by the 14th July 2017, so that come Mandela day all our parcels can be ready for delivery to our charities.

Each branch is to please nominate a charity of its choice and select a representative who will on Mandela Day 18th July handover their winter goodies and share the love and warmth. This is a national campaign and we urge our massive national network of colleagues and members to dig deep into their hearts and make this a success.

For any further information or assistance, please forward queries to: info@sada.co.za

Thank you and have a magical winter!
SADA Staff
Planning for Financially Independent Retirement

ABSTRACT

Objectives: The study investigated whether dentists in South Africa are actively planning for retirement and if they are confident about being able to retire as financially independent.

Methods: An anonymous online questionnaire was used to collect data from private dental practitioners who were members of the South African Dental Association. Stata release 11 was used for descriptive statistical analysis.

Results: The majority of the respondents (71%) were male and 42% of respondents were older than 50 years of age. It was mostly the older respondents, namely 71% of 41-50 year old respondents, 94% of 51-60 year old respondents and 72% of respondents older than 60 years, who were actively planning for financial independence at retirement. More than half of the respondents (54.35%) were not confident that they would be able to retire as financially independent and think they will have to postpone their retirements.

Conclusion: Retirement planning is much more complex than simply contributing to a pension, provident or retirement annuity fund. Dental schools can play an important role in equipping dentists with the necessary knowledge and skills to enable proper retirement planning, and to encourage early retirement saving and investment to ultimately ensure financially independent retirement.

Key words: Dentists, retirement, South Africa

INTRODUCTION

Most individuals look forward to retirement as a time to relax and start enjoying life. Retirement can be defined as “the exit from an organisational position or career path of considerable duration, taken by individuals after middle age, and taken with the intention of reduced psychological commitment to work thereafter”.¹ In the past, age 65 was considered the mandatory retirement age, but today workers face many choices regarding the time of their retirement.² Concern about adequate income during retirement is an important factor that influences many individuals when choosing an age to retire. Research has shown that finances are the strongest single predictor of the decision to retire and that people are more likely to leave the workforce if they can financially afford to retire than if they cannot.³⁴ Other predictors for retirement include health (either mental or physical), and occupational stress.⁴ Retirement planning requires knowledge of tax laws, compound interest, present and future value of money and of investment strategies. It is therefore much more complex than merely contributing to a pension, provident or retirement annuity fund.¹ In South Africa, it is of concern that many people are frankly apathetic towards retirement planning. The 2015 Sanlam Benchmark survey indicated that more people are using their pension fund money to pay debt when they change work positions or are being retrenched. Furthermore, only one in every four South Africans will be able to maintain their lifestyle on retirement.²³ These findings were further supported by Momentum and Unisa’s latest index on financial wealth of South African households, which found that only 17% of households indicated that they have enough money to retire.⁵ According to Swart⁶ less than one out of every ten individuals in South Africa is financially independent when retiring. These statistics might be indicative of a general lack of knowledge amongst individuals about what proper retirement planning involves or how to embark on such planning.

Dental practitioners in private practice have to make provision for their retirement mostly through annuity funds and other investments during their working life, while some also rely for additional financial support on the income that they will gain when selling their practices on retirement. The American Dental Association’s 2010 survey on Retirement and Investment indicated that 12.7% of dentists rely on the sale of their practice for retirement income, while 62.4% rely on family retirement savings (e.g. annuities) and 4.8% rely on other sources like real estate.
and rental income. However, relying on a practice sale as even a part of a retirement strategy is risky according to some experts.

The economy is wreaking havoc on dental practice profits, and nearly two-thirds of American dentists acknowledged that they will have to postpone retirement due to the current economy. In contrast to this, a study among Australian dentists found that they appear overall to be well prepared for retirement and have a significant amount of wealth stored in easily accessible, high return assets which they intend to spend on financing their retirement. What do South African dentists say about retirement? Do they feel as satisfied as their Australian colleagues about their retirement plans? Or are they rather sharing their American colleagues’ sentiment about having to postpone retirement due to financial constraints? The study aims to shed some light on the preparedness of dentists in South Africa for retirement. No previous studies on this topic could be found.

AIM
The study investigated the perceptions of South African dentists in private practice, who were members of the South African Dental Association, about their preparedness for retirement. The objectives were to determine:
- The age at which dentists plan to retire and whether that is a realistic goal.
- Whether dentists are actively planning for retirement.
- Whether dentists are confident that they will be able to retire as financially comfortable.

METHODS
The study formed part of a larger study that investigated the perceptions of dentists on strategic management to ensure a viable dental practice in South Africa. Permission to conduct the research study was obtained from the Research and Ethics Committee of the Faculty of Health Sciences, University of Pretoria. A cover letter that explained the purpose of the study and which invited dentists in private practice to participate was sent by the South African Dental Association (SADA) to all members of SADA’s electronic database. The cover letter contained the link to the online questionnaire. Those who agreed to participate were routed via a link in the letter to the self-developed questionnaire, which was hosted online at SurveyMonkey and was used to collect data for the study. Retirement planning was a subsection of the questionnaire and consisted of four questions specifically designed to ensure that respondents were confident that they would be able to retire in a financially independent state. Stata Release 11 was used for data analysis, which was mainly descriptive in nature.

RESULTS
The survey was sent to 3367 members of the South African Dental Association (SADA). The SADA electronic database includes members working in the public sector, members outside the borders of South Africa, Oral Hygienists as well as Dental Therapists. The questionnaire requested feedback only from dentists in private practice. A total of 184 respondents answered the questions related to retirement planning. The majority of the respondents (70.65%) were male and 41.85% of respondents were older than 50 years of age. Demographic details of the 184 respondents are summarised in Table 1.

| Table 1: Demographic distribution of respondents |
|---|---|---|
| Sex | n | % |
| Female | 54 | 29.35 |
| Male | 130 | 70.65 |
| Age | n | % |
| <30 | 25 | 13.59 |
| 31-40 | 44 | 23.91 |
| 41-50 | 38 | 20.65 |
| 51-60 | 48 | 26.09 |
| >60 | 29 | 15.76 |
| Year qualified | n | % |
| 1960-1970 | 3 | 1.63 |
| 1971-1980 | 32 | 17.39 |
| 1981-1990 | 50 | 27.17 |
| 1991-2000 | 33 | 17.94 |
| 2001-2010 | 58 | 31.52 |
| >2010 | 8 | 4.35 |
| Years in Practice | n | % |
| 0-5 | 28 | 15.22 |
| 6-10 | 25 | 13.59 |
| 11-15 | 23 | 12.90 |
| 16-20 | 17 | 9.24 |
| >20 | 91 | 49.45 |
| Province | | |
| Eastern Cape | 17 | 9.24 |
| Free State | 10 | 5.44 |
| Gauteng | 72 | 39.13 |
| North-West | 4 | 2.17 |
| Kwazulu-Natal | 28 | 15.22 |
| Limpopo | 3 | 1.63 |
| Northern Cape | 4 | 2.17 |
| Mpumalanga | 13 | 7.07 |
| Western Cape | 33 | 17.93 |
| Alma Mater | | |
| University of Limpopo (Medunsa) | 7 | 3.80 |
| University of Pretoria | 85 | 46.20 |
| University of Stellenbosch | 24 | 13.04 |
| University of Western Cape | 28 | 15.22 |
| University of Witwatersrand | 31 | 16.85 |
| Other | 9 | 4.89 |
| Type of practice | | |
| Solo practice | 108 | 58.70 |
| Partnership | 39 | 21.20 |
| Other | 37 | 20.10 |

Respondents aged between 31 and 50 years of age were most commonly found to be confident that they would be able to retire in a financially comfortable state (Figure 1).
The majority of respondents (69.57%) are actively planning for retirement. The results of this study indicate that the majority of dentists in private practice, whilst the survey documents were in fact sent out to every member of the Association, whether in public service, or as Dental Therapist or Oral Hygienist. (Desired sample size from estimated number of private practitioners at 2760 SADA members at 95% confidence limit would have been about 350 responses). Within those limitations, however, the outcomes of the descriptive analysis are still revealing of a trend.

From the results it is evident that those dentists who participated in this section of the overall study still value the traditional opinion about retirement age being near 65 years of age, as the majority of respondents indicated 65-69 years of age as being "good" for retirement. A large percentage (22.83%) of respondents preferred retirement at 70 years or older. It may be assumed that as the officially recognized retirement age for South Africans is 65, this may have influenced the responses, although the reasons for the preferences were not explored. Another assumption, which was to some degree strengthened by the other results of this study, may be that financial constraints simply prevent dentists from retiring earlier, and that the majority then have no option other than to work at least to the age of 65 years, or even longer. Research has shown that most of the time people will, wisely, retire only if they can financially afford to do so. It is also a known fact that people worldwide are living longer, and studies postulate that individuals expecting to live longer will retire at an age later than those expecting to die early, as they will need greater wealth to finance more years of retirement. This might also explain the intentions of many dentists to retire at an older age.

The results of this study indicate that the majority of respondents (69.75%) are actively planning for retirement. Clearly, it is mostly the older respondents, namely 71% of 41-50 year old respondents, 94% of 51-60 year old respondents and 72% of respondents older than 60 years, who are committed to planning for financial independence at retirement. A survey among Australian dentists aged 50 years and older enquiring about their preparedness for retirement, reported comparable findings, namely that 84% of older dentists are actively planning for financial independence at retirement, 12% were planning but not seriously, and only 4% were not involved in financial planning at all.13 This might also explain the intentions of many dentists to retire at an older age.

When asked to indicate what age respondents feel would be a good age for retirement, the majority (30.43%, n=56) indicated that 65 to 69 years is desirable, followed by 22.83% (n=42) of respondents who indicated that 70 years or older will be appropriate (Table 2).

The majority of respondents (69.57%) are actively planning for their retirement and only 5.98% are not involved in any financial planning for retirement (Table 2).

Twenty percent of respondents younger than 30 years of age are currently not involved in retirement planning at all, while this also applies to 7% of respondents older than 60 years (Figure 1). It was mostly the older respondents, namely 71% of 41-50 year old respondents, 94% of 51-60 year old respondents and 72% of respondents older than 60 years, who are actively planning towards having financial independence at retirement (Figure 1).

Results indicated that more than half of the respondents (54.35%), however, are not confident that they will be able to retire financially independent and think they will have to postpone their retirements (Table 2).

DISCUSSION
Most people look forward to retirement as a time to start relaxing and enjoying life. Unfortunately, the harsh reality is that only a few can afford to retire financially independent and to maintain their pre-retirement lifestyle. In contrast to Australian dentists who seem to be generally well-prepared for retirement,13 American dentists are not so confident about financially independent retirement, and think they will have to postpone their retirement.12 The current study investigated the perception of dentists in South Africa on their preparedness for financially independent retirement.

The response of only 184 dentists from 3367 questionnaires is admittedly disappointing but it is to be recognised that the request to complete the Questionnaire was limited to dentists in private practice, whilst the survey documents

<table>
<thead>
<tr>
<th>Table 2: Retirement planning</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good age for retirement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 55 years</td>
<td>12</td>
<td>6.52</td>
</tr>
<tr>
<td>55-59 years</td>
<td>33</td>
<td>17.94</td>
</tr>
<tr>
<td>60-64 years</td>
<td>35</td>
<td>19.02</td>
</tr>
<tr>
<td>65-69 years</td>
<td>56</td>
<td>30.43</td>
</tr>
<tr>
<td>70 years and older</td>
<td>42</td>
<td>22.83</td>
</tr>
<tr>
<td>Never</td>
<td>6</td>
<td>3.26</td>
</tr>
<tr>
<td>Will selected age for retirement be a realistic goal?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>108</td>
<td>58.70</td>
</tr>
<tr>
<td>No</td>
<td>76</td>
<td>41.30</td>
</tr>
<tr>
<td>Situation regarding retirement planning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am actively planning for financial independence at retirement</td>
<td>128</td>
<td>69.57</td>
</tr>
<tr>
<td>I am planning for retirement but not seriously</td>
<td>45</td>
<td>24.46</td>
</tr>
<tr>
<td>Currently I am not involved in financial planning for retirement at all</td>
<td>11</td>
<td>5.98</td>
</tr>
<tr>
<td>Do you feel confident that you will be able to retire comfortably (financially independent)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes, I am confident</td>
<td>84</td>
<td>45.65</td>
</tr>
<tr>
<td>No, I am not confident and will have to postpone my retirement</td>
<td>100</td>
<td>54.35</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Situation regarding retirement planning</th>
<th></th>
<th></th>
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<tr>
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<td>11</td>
<td>5.98</td>
</tr>
</tbody>
</table>

Another assumption, which was to some degree strengthened by the other results of this study, may be that financial constraints simply prevent dentists from retiring earlier, and that the majority then have no option other than to work at least to the age of 65 years, or even longer. Research has shown that most of the time people will, wisely, retire only if they can financially afford to do so. It is also a known fact that people worldwide are living longer, and studies postulate that individuals expecting to live longer will retire at an age later than those expecting to die early, as they will need greater wealth to finance more years of retirement.13 This might also explain the intentions of many dentists to retire at an older age.

The majority of respondents (69.57%) are actively planning for retirement. Clearly, it is mostly the older respondents, namely 71% of 41-50 year old respondents, 94% of 51-60 year old respondents and 72% of respondents older than 60 years, who are committed to planning for financial independence at retirement. A survey among Australian dentists aged 50 years and older enquiring about their preparedness for retirement, reported comparable findings, namely that 84% of older dentists are actively planning for financial independence at retirement, 12% were planning but not seriously, and only 4% were not involved in financial planning at all.13 The fact that 45% of respondents in this study aged 31 to 40 years and 28% of respondents younger than 30 years are not seriously planning for retirement, and that 20% of respondents younger than 30 years are not planning for retirement at all, might be a concern. Most experts agree that one should begin to plan and save for retirement as early as possible, preferably as soon as an income is being earned.16,22 The later you start to save, the less you will have when you reach retirement, and when you start saving only as you get older, you will also have to put more into retirement savings to try to make up for the years when you were earning an income but not saving towards retirement. Recognising the need for an early commitment to preparation for retirement, Dental Schools can definitely play a role in educating dental students on the importance of proper retirement planning and early retirement saving and investment.
More than half of the respondents in this study (54.35%) are not confident that they will be able to retire financially independent and think they will have to postpone their retirement. This finding came as no surprise, given similar findings amongst American dentists, and the general statistics indicating that most individuals in South Africa will not be able to retire financially independent. But if financial independent retirement seems to be such an elusive goal for most, the question must then certainly be just how much do you then actually need in order to retire with financial confidence? Unfortunately there is no easy, straightforward answer to this question, since the requisite amount of retirement funding is based on your specific needs (e.g. health care benefit expenses) and your spending habits. Furthermore, there are three variables influencing retirement capital that are unpredictable, namely: how long you will live, what inflation will be in the future, and what return you will earn on investments.

Although it is difficult to determine an exact amount which will be needed, there are broad ranges and guidelines used by financial experts that can give you some idea of what should be enough. Popular financial guru Dave Ramsey advises that one should save a certain percentage of your income (typically 15%) annually for retirement. Swart proposes as a broad, conservative estimate that one should have at least 10 times your annual gross salary in investment if you want to retire at age 65 and if you want to retire earlier, then at least 12 times your annual gross salary. Another calculation commonly used by financial advisors to determine retirement capital for financial independent retirement is the 4% rule, first established by William Bengen 22 years ago. Bengen used historical returns to illustrate that with a balanced investment portfolio one can safely withdraw 4% the first year and then an inflation-adjusted amount every year for 30 years of retirement without a significant risk of running out of money. According to this rule, then, one needs enough retirement capital saved to be able to meet your annual expenses in year one of retirement by withdrawing 4% of your nest egg. To illustrate, if you need to generate from your retirement capital R50 000 per month to cover expenses in year one, you’ll need to have R15 000 000 saved for retirement (R15 000 000 x 4% = R 600 000 p.a. = R 50 000 p.m.) To reverse the maths: to be able to withdraw 4% in year one means having 25 times your annual spending invested for retirement. Although the 4% rule is widely used in the financial world due to its simplicity to understand and implement, it has also received much criticism over recent years due to certain facts such as it does not account for variable spending patterns, different tax brackets, investment costs, market volatility and different asset classes amongst other considerations.

Although only guidelines, the above numbers might be quite sobering to many readers. Unfortunately, the reality remains that most people underestimate what they will actually need for retirement, and do not save enough for financially independent retirement. The importance of early retirement saving and investment can therefore not be stressed enough. For those amongst us that have not given much thought to retirement planning, the advice will be to sit down and do it as soon as possible. Swart proposes three steps when planning for retirement. First, establish your retirement goals: e.g. maintaining an equal standard of living as before retirement or aiming for a 75% replacement ratio, your desired age of retirement, just saving enough to last you for your retirement or leaving behind a legacy for your loved ones. Secondly, establish an amount required to attain the set goals. This amount is determined by assessing the expenses and income during retirement. Lastly, prepare an investment portfolio within the constraints of your personal financial budget.

CONCLUSION

Retirement planning is much more complex than simply contributing to a pension, provident or retirement annuity fund, since it also requires knowledge of tax laws, compound interest, present and future time value of money and investment strategy. Financial experts also agree on the importance of starting retirement planning, saving and investment early in one’s career. Statistics indicate that most individuals in South Africa will not be able to retire financially independent. The majority of respondents in this study also share this sentiment and think they will have to postpone their retirement due to financial constraints. Dental schools can play an important role in equipping dentists with the necessary knowledge and skills to enable proper retirement planning, and early retirement saving and investment to ultimately ensure financial independent retirement.

LIMITATIONS

The study reports on the responses of a relatively small sample of the private dentist population of South Africa who are members of SADA and have internet access. Whilst the data may then have limited application, the philosophy and encouragement regarding early financial planning are well supported.

Acknowledgement

We would like to acknowledge Prof PH Becker (Biostatistician, Faculty of Health Sciences, University of Pretoria) for his help with the statistical analysis of results.

Declaration: No conflict of interest declared.

References

6. Van Rooyen G. Concerns about retirement apathy (Kommor oor ‘aftrede-apatie’). Beeld. 2015 May 29.
An assessment of the accuracy of a panoramic radiograph as compared with cone-beam tomography in TMJ imaging

SUMMARY
The articular disc of the temporomandibular joint (TMJ) cannot be seen on plain x-ray examination but an accurate assessment of the space between the glenoid fossa and the head of the condyle may provide the clinician with a clue to a possible pathological problem. Measurements of the TMJ space seen on panoramic radiographs (PAN) and on cone beam computerised tomographic scans (CBCT) were carried out on films taken of left and right TMJs of forty-six patients. On each image a vertical line was drawn digitally from the highest point of the condylar head to the glenoid fossa of the temporal bone. The lengths of the lines were recorded on Galileo software and compared using the Bland-Altman statistical test (total sample size 92 joints). Bias was achieved at mean differences of 1.03mm with a p-value of <0.001 which was statistically significant. Left and right TMJ mean values showed a 0.09 mm difference. Age was insignificant at p=0.40. The Levels of Agreement indicated workable concord between the methods although a wide range was evident.

INTRODUCTION
The Temporomandibular joint (TMJ) is a synovial articulating cartilaginous joint between the mandibular condyle and the glenoid fossa of the temporal bone. It is divided into upper and lower compartments by a fibro-cartilaginous articular disc. The upper joint compartment allows for protrusion, retraction and lateral movements whereas the lower joint compartment allows for hinge movements only, resulting in movements in the vertical dimension.1

ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBCT</td>
<td>cone beam computerised tomographic</td>
</tr>
<tr>
<td>IQR</td>
<td>Inter-quartile Range</td>
</tr>
<tr>
<td>LoA</td>
<td>Limits of Agreement</td>
</tr>
<tr>
<td>PAN</td>
<td>panoramic radiograph</td>
</tr>
<tr>
<td>TMJ</td>
<td>temporomandibular joint</td>
</tr>
</tbody>
</table>

All of these mandibular manoeuvres may occur during mastication and are regulated by a combination of neurological control mechanisms together with complex muscle systems (muscles of mastication) that react to the nervous stimuli. However, limitations in mobility can be caused by muscular dysfunction or restricted movement of the articular disc which may constrain certain TMJ movements and may subsequently lead to TMJ dysfunction.2 The position of the articular disc cannot be seen on plain x-ray examination, eg. a panoramic radiograph, but an accurate assessment of the space between the glenoid fossa and the head of the condyle may provide the clinician with a clue to a possible pathological problem.3

Causes of TMJ dysfunction may be physiological, psychological or pathological. Physiological conditions which may be associated include excessive occlusal forces; malpositioned teeth due to crowding; early exfoliation or extraction of primary teeth resulting in a bite of convenience or an incorrect vertical or horizontal jaw relationship.4,5

Psychological conditions include sleep apnoea; psychosocial distress; environmental stress; bruxism and poor control of chronic TMJ pain.6-9 Pathological conditions that influence TMJ movement are osteo-arthritis of juveniles and adults; trauma such as motor vehicle accidents; benign and malignant lesions and cysts within the joints.10-12 In order to assess any of these conditions an accurate diagnosis is essential.

Radiographic interpretation is an important diagnostic tool in the evaluation of TMJ dysfunctions to identify bony changes or space deficiencies between the head of the
condyle and the glenoid fossa. Several studies have reported on the accuracy of cone-beam tomography (CBCT) in the examination of the TMJ, but few have evaluated the use of panoramic radiographs (Pans) for assessment of the TMJ space. A study in 1980 stated that “due to magnification, lack of definition and superimposition of structures, panographs may be diagnostically inferior to intra-oral radiography”. Nevertheless Pans still appear to be widely used for diagnosis of TMJ space deficiencies and bone disorders. Since 1982, digital radiography has enabled the electronic storage of panoramic images for easy recall.

In 1998 an innovation, the three-dimensional cone-beam computerised tomogram, (CBCT) was introduced. The technique provided the practitioner with images at various depths within the tissue, unimpeded by superimposed structures. CBCT provided surface and sectional information about the craniofacial structures. Such equipment, however, is extremely costly and moreover should not be utilised as a routine modality. For this reason the average dentist relies on a Pan. Despite certain flaws, e.g. superimposition of structures, Pans are still currently being used to diagnose bony changes and joint space deficiencies and have allowed generally correct interpretation of the bony components of TMJ. The question may be raised, however, as to what are the levels of agreement between the data measured on a Pan with that measured on the purportedly technically superior CBCT projection.

This study specifically aimed to determine the extent of agreement between data derived from Panoramic radiographs and CBCT scans of the TMJ in determining the height of the space between the head of the mandibular condyle and the glenoid fossa of the temporal bone.

**MATERIALS AND METHODS**

The number of radiographs taken at the Radiology section of the Wits School of Oral Health Sciences includes approximately 50 Pans per day and about 10 CBCT scans per week. This routine provided sufficient material for the current project. From the archives of the Radiology Section, the records of sixty three patients who had been subjected to both a Pan and a CBCT scan between March and July 2015 inclusive were randomly selected, using the Excel random number selection programme, and were assessed for inclusion in the study. All radiographic views were required to be of highly acceptable quality. Seventeen cases were excluded from the study for reasons of the patient having undergone condylar fusion, condylectomy, condylar prosthesis or another form of condylar pathosis. Hence a total of 92 radiographs of joint spaces were included. Each radiograph demonstrated completely discernible TMJ spaces enabling accurate measurement on both left and right sides. The joint space was defined by a digitally drawn vertical line from the highest point of the condylar head to the glenoid fossa of the temporal bone for each radiograph (Figure 1). The standardized measuring gauge included in the Galileo Gax 5 software (Sirona Dental, SA) of the Galileos Cone-Beam scanner was used in the determination of all measurements. The Pans were assessed within their fixed focal troughs (Figure 2) while the CBCTs were assessed at the deepest levels of their tangential views with the patient in the correct occlusal position, having closed on a standardized bite stick. Each CBCT was further viewed in the cross-sectional mode in order to ensure that the vertical dimensions of the tangential mode corresponded to those of the cross-sectional views (Figure 3). The measurements were performed by one researcher in the first instance and 20% were repeated without collusion by a second.

The data were recorded electronically and were analyzed using the Bland-Altman method for assessing agreement between two methods of clinical measurement. The effect of age and sex on the bias between the methods was determined by regressing the between-method differences on patient age and sex.

Data analysis was carried out using SAS (version 9.4 for Windows). The 5% significance level was used.

**RESULTS**

The final sample of 46 patients was aged between 10 and 68 years (median 29 years) and 63% were male. The inter-observer agreement between the two sets of data was found to be 89%.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Units</th>
<th>N</th>
<th>Median</th>
<th>Interquartile range</th>
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<td>46</td>
<td>29</td>
<td>20</td>
<td>10</td>
<td>68</td>
</tr>
<tr>
<td>PAN</td>
<td>mm</td>
<td>92</td>
<td>3,03</td>
<td>2,20</td>
<td>0,78</td>
<td>10,00</td>
</tr>
<tr>
<td>CBCT</td>
<td>mm</td>
<td>92</td>
<td>4,45</td>
<td>3,44</td>
<td>1,49</td>
<td>10,58</td>
</tr>
</tbody>
</table>
Perhaps the immediately striking feature displayed by the descriptive statistics was the variation in the height of the joint space, for this ranged from around 1 mm right up to over 10 mm (Table 1). In general the CBCT measurements were greater than the corresponding Pan data (Table 1).

The Bland-Altman plot of the difference between the CBCT and PAN measurements against the mean of the two measurements is shown in Figure 4. The calculated bias of 1.03 mm differed significantly from zero (p<0.0001). The lower and upper Levels of Agreement were determined at -3.20 and 5.25 respectively. Hence, results measured by CBCT may at the extreme statistical agreement levels be 5.25 mm above the measurements made on Pans or 3.20 mm below. The bias did not increase or decrease with increasing mean space gap, as determined by a regression of the differences on the means (p=0.097). The effect of age and sex on the bias was not significant (p=0.40 and 0.17 respectively).

A priori limits of agreement of -1.5 to 1.5mm were set at the outset, determined on the basis of biological and clinical criteria. Only 54% of the data points fall within these LoAs.

DISCUSSION
The ideal position of the mandibular condyle within the glenoid fossa is often influenced by the dimensions of the TMJ space. Prior research has related the dimensions of TMJ space, joint morphology and joint pathology to dental occlusion and positional variations of the condyle within the joint. Pans have commonly been used to provide an initial assessment of these situations, with minimal limitations. Hence, Pans remain the prime TMJ diagnostic modality. The current study set out to investigate whether measurements of the joint space made on Pans were of a validity commensurate with those achieved by CBCT scans, a technological advance.

Although the TMJ space, assessed anatomically, has been shown to vary with age and gender, these relationships were not shown in this study to have an effect on the differences between the two methods. However, there was variation in the measurements recorded from the different radiographs, as has been found in previous studies. The Bland and Altman analysis revealed a relatively small bias (the mean of the differences between the techniques) but this was associated with statistically determined Levels of Agreement which were quite widely separated, and in fact exceeded the ranges reported from other studies. A small bias but wide limits of agreement may indicate that whilst the average accuracy of the measurements may be reasonable, the data is too variable to be useful. Consider that the actual measurements of the joint space ranged from 0.78 to 10.58 mm. Yet the statistically determined Limits of Agreement extended from -3.20 to 5.25 mm, too wide a range to be clinically precise.

Bland and Altman recommend that Limits of Agreement be set at the outset of these comparisons, an a priori exercise based on biological and clinical criteria. Applying the Limits of Agreement selected a priori in this study (+1.5 and -1.5) showed a lack of agreement between the radiological methods when reasonable clinical expectations are taken into account.

CONCLUSION
The two radiological methods assessed in the study have not been shown to be interchangeable when precision measurements of the joint space are required. Whilst CBCT scans may be the first choice of clinicians, the Panoramic radiograph nevertheless offers data which may be useful in the initial diagnostic exercise, provided that interpretation is done with caution. The elevated cost and radiation dose associated with CBCT scanning mitigate against its routine usage.

LIMITATIONS OF THE STUDY
No assessment of the repeatability of the measurements was done. Joint space was assessed in only one dimension, whereas considerable variation could have occurred in other aspects.
Declarations: Neither of the investigators hold any interest in either of the radiation units investigated.

Acknowledgments
The researcher would like to thank the Ethics Committee for allowing the research to be conducted at the Charlotte Maxeke Academic Hospital. Grateful appreciation is recorded to Dr Petra Gaylard of Data Management and Statistical Analysis, University of the Witwatersrand, Johannesburg.

References
Impacted mandibular third molars: the efficacy of prophylactic antibiotics and chlorhexidine mouthwash in preventing postoperative infections

ABSTRACT

Introduction: There are dissenting opinions regarding the efficacy of prophylactic antimicrobial agents in third molar surgery.

Objective: To determine: 1) The efficacy of a prophylactic antibiotic regimen compared with a chlorhexidine mouthwash in reducing postoperative infections in mandibular third molar surgery. 2) The pattern of presentation and the indications for extraction of mandibular third molars.

Design: 100 surgical patients were randomly assigned to two groups (group 1: 15 ml of chlorhexidine rinse for one minute preoperatively. group 2: 2g amoxicillin orally one hour preoperatively).

Methods: Postoperative complications and surgical site infections were assessed seven days postoperatively. The patients’ age, gender, type of impaction and indications for extraction were also recorded. Data was analyzed using the statistical package STATA 13.1.

Results: The infection rate was 8% and 6% for groups 1 and 2 respectively. No statistically significant difference in surgical wound infection was found between the two groups.

Mesioangular impaction was the most common type of impaction, and pericoronitis was the most prevalent indication for extraction.

Conclusion: Amoxicillin and chlorhexidine prophylaxis are equally effective in reducing postoperative infections in third molar surgery. Hence, antibiotic prophylaxis is not indicated for routine administration in non-immunocompromised patients for such procedures.
Antimicrobial mouthwash agents have for long been used for prophylaxis or treatment of oral infections in dentistry. However, their usefulness in reducing postoperative infections in third molar surgery has often been overlooked, probably due to the limited number of studies which have been carried out to assess their efficacy.\textsuperscript{10-12}

Against this background, the current study was designed to evaluate the efficacy of prophylactic antibiotics and a chlorhexidine mouthwash in preventing postoperative infections following removal of mandibular third molar teeth. Furthermore, an attempt was made to generate a pool of data not only in the demographics and distribution patterns of patients presenting with impacted third molar teeth but also in treatment outcomes after extraction. Such data are essential in establishing evidence based clinical guidelines that can further assist in the development of sound treatment protocols.

MATERIALS AND METHODS

Study Design

A prospective randomized controlled trial was conducted on patients who presented to the Oral and Dental Department of Ermelo Provincial and Rob Ferreira hospitals for third molar extractions under local anaesthesia between October 2014 and October 2015. The study was approved by the Human Research Ethics Committee (HREC) of the University of the Witwatersrand (Certificate No. M140435). Medically competent patients, with ages ranging from 18-50 years were included in the study after each had signed an Informed Consent declaration. Exclusion criteria were defined as patients having comorbidities or third molar teeth with incomplete root formation. The surgical procedures were timed and those with an operating time above one hour were excluded from the study sample.

Population

The study sample was derived from patients who reported for mandibular third molar extractions at one of the two hospitals. One hundred and ten patients requiring third molar surgical extractions were recorded for the study. Of that total, 100 patients met the inclusion criteria. Seven patients did not attend the recall appointment and three patients had undergone an operating time of more than one hour.

To test the effectiveness of the prophylactic regimen in the study, patients were randomly assigned to two groups (using two sealed envelopes). In the first group (control group), patients were instructed to rinse with 15ml of 0.2% chlorhexidine (with alcohol) mouthrinse for one minute prior to the surgery. In the second group (test group), 2g amoxicillin was administered orally one hour before the surgery.

The Control group consisted of 50 patients; 22 males and 28 females.

The Test group consisted of 50 patients; 26 males and 24 females.

All the operations were of a surgical nature and were performed under local anaesthesia (2% lignocaine with 1:80000 adrenaline) by a single operator with six years of experience in using a standardized procedure.

The surgery was carried out based on the university’s protocol on third molar extraction. Envelope or triangular mucoperiosteal flap elevation with ostectomy and/or odontectomy was achieved using a surgical scalpel blade no. 15. Ostectomy was performed using a crosscut tapered fissure bur mounted on a straight handpiece. The tooth was sectioned appropriately where necessary depending on the surgeon’s judgement whilst trying to achieve minimal surgical invasion.

Following the removal of the tooth, the surgical site was debrided and irrigated with sterile water. Primary closure of the flap was achieved using resorbable chromic catgut sutures, 3/0.

The time of surgery was recorded as the time span between the first incision and the last suture placed.

Table 1: Description of the Study Population

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
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<td></td>
</tr>
<tr>
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<td>52.00</td>
</tr>
<tr>
<td>Male</td>
<td>48</td>
<td>48.00</td>
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<tr>
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<tr>
<td>Indication for Extraction</td>
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<tr>
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<td>39.00</td>
</tr>
<tr>
<td>Abscess</td>
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<td>3.00</td>
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<tr>
<td>Caries</td>
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<tr>
<td>Periodontal disease</td>
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<td>10.00</td>
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<tr>
<td>Root resorption</td>
<td>2</td>
<td>2.00</td>
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<tr>
<td>Atypical facial pain</td>
<td>6</td>
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<tr>
<td>Oral pathology</td>
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<tr>
<td>Prophylactic removal</td>
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<tr>
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<tr>
<td>Time taken in minutes (mean, std)</td>
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<tr>
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<td>Chlorhexidine mouthwash</td>
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<td>CHX AMOX</td>
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<td></td>
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<td>42</td>
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<tr>
<td>Pain</td>
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<td>6</td>
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<tr>
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<td>Alveolitis</td>
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<td>3</td>
</tr>
<tr>
<td>Infection</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

CHlorhexidine =CHX Amoxicillin =AMOX
Patients were prescribed 1g of Paracetamol with codeine and 400mg of Ibuprofen as analgesics and postoperative instructions of care were given, which included rinsing with warm saline three times daily starting from the day after surgery.

A recall visit was scheduled seven days later and any postoperative complications were noted in a questionnaire. Pain, swelling, trismus, alveolitis and surgical site infection were recorded.

Trismus was defined as an inability to clear an inter-incisal distance of at least 2 cm. Alveolar osteitis was defined as pain that arises 2-5 days after surgery, the presence of necrotic tissue and/or exposed bone, and the absence of clot. Infection was defined as a purulent discharge at the extraction site with/without painful induration.13-15 If any complication arose before the scheduled recall visit, the patient was asked to report back to the hospital to receive appropriate treatment and postoperative antibiotics were then prescribed, if required. The complication was recorded on a data collection sheet.

Data collected were analyzed statistically using Stata13.1 for Windows. Participants were described using frequencies and percentage for categorical predictors, and means and standard deviations for continuous variables.

Associations were investigated using appropriate statistical tests such as the Student’s t-test and Fisher’s exact test for categorical predictors and ANOVA test for equal variance to analyze any significant differences inter-groups. Statistical tests used were two sided and p values ≤ 0.01 were considered significant.

**RESULTS**

The sample included almost equal numbers of males (n=48, 48%) and females (n=52, 52%) with ages ranging from 18-50 years (mean: 27.75 +/- 5.79). Many patients presented with more than one complication. Alveolitis was recorded in the presence or absence of infection. For the purpose of this study, the main focus was on infection as a complication.

In the control group, to whom had been administered a preoperative rinse of chlorhexidine, four patients presented with postoperative infections whereas in the test group who had consumed a bolus of preoperative antibiotics, three patients presented with postoperative infections. The infection rate recorded was 8% for the chlorhexidine group and 6% for the antibiotic group. The Fisher’s exact test between the two groups of patients demonstrated a p value > 0.01 indicating no significant difference in infection rates between the chlorhexidine group and the antibiotic group. In addition, there was no association between the presence of infection and the following variables:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Presence of Infection</th>
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<th>p-value</th>
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<tr>
<td>Sex</td>
<td></td>
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<tr>
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<td>4 (7.69 %)</td>
<td>48 (92.31%)</td>
<td>52</td>
</tr>
<tr>
<td>Male</td>
<td>3 (6.25%)</td>
<td>45 (93.75%)</td>
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</tr>
<tr>
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<td>Prophylactic removal</td>
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<td>4</td>
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<tr>
<td>Tooth in line of fracture</td>
<td>0</td>
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<td>1</td>
</tr>
<tr>
<td>Time taken in minutes (median, IQR)</td>
<td>28 (20-35)</td>
<td>20 (15-26)</td>
<td>0.07</td>
</tr>
</tbody>
</table>

The mean duration of the surgery was 22.1 (+/- 5.79) minutes. The minimum and maximum times to complete the procedure were recorded as 5 and 54 minutes respectively.

The most common indication for extraction was pericoronitis (n=39, 39%). Mesioangular impactions (n=46, 46%) followed by horizontal impactions (n=37, 37%) were the highest incidences of angulations recorded.

An independent Student-t test demonstrated a marginal association (p= 0.01) between the mean age of patients that presented for mandibular third molar extraction and their gender.

No association existed between the mean age and the different types of impaction was revealed by the Anova test of equal variance (p= 0.39).

Moreover, the Fisher’s exact test showed no association between the type of impaction and the gender distribution of participants (p= 0.467) or the type of impaction (p= 0.07).
**DISCUSSION**

This study attempted to compare the efficacy in prophylaxis of two different therapeutic strategies prior to mandibular third molar extraction:
1. A one minute oral rinse with 15ml of chlorhexidine mouthwash
2. A single preoperative bolus of 2g Amoxicillin

One hundred and ten patients were included in the study. Seven patients did not attend their recall visit and were excluded from the study. Three patients had an operating time for extraction of above one hour and were not included due to increased exposure to bacteria within the oral cavity which could compromise the results. In addition, the procedures were performed in the pre-surgical absence of pericoronitis or active infection. The infection rate recorded in this study showed no significant difference between the chlorhexidine group and the antibiotics group (p> 0.01).

Based on this finding, it can be deduced that the results in terms of efficacy obtained with either antimicrobial therapy is comparable and therefore an assessment of their mechanism of action, risk and cost benefits was considered before making a recommendation.

Chlorhexidine gluconate is a well-known antimicrobial agent with a broad spectrum of activity against both Gram positive and Gram negative bacteria, facultative anaerobes and aerobes, yeasts as well as certain viruses including HIV. It exists in the form of cations and anaerobes and aerobes, yeasts as well as certain viruses. Its use in the routine disinfection of mucosa and bacteria exhibiting an immediate as well as a prolonged antimicrobial effect on a broad spectrum of bacteria and fungi. Its use in the routine disinfection of patients and medical devices in ICU or in surgical scrubs has been well established. In dentistry, chlorhexidine in the form of an oral rinse is often used for prophylaxis or in the treatment of oral infections.

In this study, a 0.2% oral rinse of chlorhexidine gluconate was used as a prophylaxis. At this concentration, chlorhexidine displays bactericidal properties by disrupting the function of cell membranes and altering the osmotic equilibrium of bacteria. The rationale behind its use in this study was to reduce the oral bacterial load at the surgical site, thereby decreasing bacteremia which harbours significant risks for post extraction infections. Organisms that have shown high susceptibility to chlorhexidine include several species of staphylococci, streptococci and various anaerobes which are important constituents of the complex oral flora.

Several studies have demonstrated that a preoperative rinse with 0.2% chlorhexidine has significant antimicrobial effects on the oral flora and post extraction bacteremia. In 1997, the American Heart Association (AHA) recommended the use of an antiseptic mouthwash to reduce bacteremia prior to any dental manipulation, before modifying the recommendations in 2007. In 2006, the British Society for Antimicrobial Chemotherapy (BSAC) recognized the importance of a preoperative rinse with a 0.2% chlorhexidine mouthwash before any dental procedures in patients at high risk of infective endocarditis. Conversely, it has also been suggested that forceful rinsing with a chlorhexidine mouthwash may actually produce bacteremia but there is no substantial evidence to confirm this hypothesis.

In addition to its broad antibacterial spectrum and substantivity, one of the major advantages of chlorhexidine is the absence of resistance to the microorganisms it affects. The few and rare documented adverse reactions to chlorhexidine include hypersensitivity, unpleasant taste or tooth discoloration. Also, there is no evidence to contradict the use of chlorhexidine mouthwash in pregnant or lactating women.

As opposed to the few studies published on the efficacy of chlorhexidine prophylaxis in third molar surgery, there is a plethora of studies on antibiotic prophylaxis. However, its usefulness in preventing postoperative infections continues to remain a matter of debate. Different treatment protocols and different antibiotics have been used and conflicting information exists regarding its benefit. Although there are definite recommendations by the American Heart Association and American Dental Association/ American Academy of Orthopaedic Surgeons (ADA/AAOS) for antibiotic prophylaxis in the prevention of infective endocarditis and prosthetic joint infection, the guidelines for prophylactic antibiotics to prevent surgical site infection in oral and maxillofacial surgery are less clear. It is widely accepted that surgical site infections are caused by the patients’ own endogenous flora and the purpose of prophylaxis is to considerably reduce the systemic level of the infective pathogens in the tissues at the operative site.

The choice of antibiotic is greatly influenced by the bacteria present at the operative site. Peterson has set forth certain criteria when choosing an antibiotic for prophylaxis. He advocates for the correct antibiotic with the narrowest antibacterial spectrum. In addition, a high enough dosage must be administered at the most appropriate time and with the shortest exposure. Amoxicillin has been the gold standard for treatment of infections or prophylaxis in dentistry due to its high efficacy against Gram-positive streptococcus and staphylococcus species as well as several Gram-negative bacteria which are common isolates in oral infection. In addition, its good absorption in the gastrointestinal tract coupled with its capacity in reaching fast and effective concentrations at the site it targets has made it an antibiotic of choice.

A 2g amoxicillin regimen one hour before surgery was used in this study based on the AHA/ADA/AAOS guidelines. Similar protocols were used in several studies with varying results on the efficacy of the prophylactic treatment. Ren et al performed a meta-analysis of 23 studies on the effectiveness of antibiotic prophylaxis in third molar surgery and concluded that when systemic antibiotics are administered before surgery, they are effective in reducing the frequency of wound infections. In contrast, in a review of published clinical trials on the efficacy of antibiotic prophylaxis, Oomens et al reported a lack of evidence to support the use of prophylactic antibiotics in lower third molar surgery.

The use of amoxicillin in the prevention of infection in dentistry is a source of major debate due to the development of antibacterial resistance and other adverse reactions such as anaphylaxis or toxicity. The World Health Organisation’s (WHO) 2014 global report on antibiotic resistance highlighted resistance as a major global threat to worldwide public health with new resistance mechanisms continuously emerging and spreading globally at an alarming rate. The development of resistance over
the years is most probably due to overuse or misuse of antibiotics. There is no doubt that the poor antibiotic prescribing practices by dentists, often motivated by factors ranging from inadequate knowledge to social factors, contribute significantly towards the formation of multiresistant bacterial strains.

Judicious use of antibiotic prophylaxis based on evidence rather than dogma is imperative. The published infection rate associated with third molar surgery ranges between 1%-12.6%. The infection rate for amoxicillin and chlorhexidine prophylaxis in this study was 6% and 8% respectively and falls within the expected rate of infection for third molar removals. Hence the efficacy of both regimens is comparable.

In view of the potential harmful complications associated with the use of antibiotics for prophylaxis and the relatively low rate of infection posed by third molar surgery, the use of amoxicillin is not warranted for such procedures. However, chlorhexidine gluconate which is a cheap, safe and broad spectrum antiseptic is recommended to reduce the oral bacterial count at the surgical site prior to making an incision.

Moreover, a session of professional scaling is desirable before third molar surgery to decrease the oral bacterial load. Ultimately, chlorhexidine must be an adjunct to proper surgical technique in an aseptic environment.

As far as demographics are concerned, the ratio of male to female in this study was 1:1.08, which shows an almost equal distribution between the two gender groups. This is in agreement with most studies that have reported no sexual predilection for impacted third molars. Other studies have shown a higher predilection for females and it is believed that mandibular growth for females stops by the time third molars start erupting, resulting in a lack of space for the tooth to erupt.

The most common type of impaction recorded was the mesioangular type (46%) followed by the vertical type (37%). Mesioangular impactions are most probably caused by the late development and maturation of the tooth germ with a resulting lack of space for the tooth to erupt in a normal position. The results are similar to those found by Hashemipour et al and Gbotolorun et al in Iran and Nigeria respectively. This is in contrast to other studies that demonstrated the vertical type of impaction to be more common. Differences in methods of classification for angulation used, variation in genetics between the populations studied or the type of food consumed in the different geographical areas may account for the discrepancies. This study also demonstrated that no correlation exists between the type of impaction and the different variables of age and gender.

The mean age of the subjects was 27.75 with a standard deviation of 5.79. The age group 25-30 years had the highest proportion of patients with impacted teeth. The delayed manifestation of patients for impacted teeth removal may be due to a lack of Oral Health Education. In certain cases there is also the wrong perception that the tooth is still growing and will erupt eventually. Moreover, due to apprehension for dental treatment, most patients in Mpumalanga visit the dentist only when they are inflicted with pain.

Pericoronitis followed by caries was the most frequent indication of the need for extractions. These results are comparable to those found by Krishnan et al where pericoronitis was the most frequent reason for extraction followed by caries. The high prevalence of these pathologies is not uncommon since they usually present with symptoms of pain which force patients to seek dental assistance. Pericoronitis in the patients seen is probably exacerbated by the accumulation of bacteria and food under the operculum. Similarly caries may have formed due to poor oral hygiene resulting in a build-up of food and debris that become impacted around the partially erupted tooth.

The implementation of oral health education in both personal and community based programs remains key to informing patients on the importance of oral hygiene. A paradigm shift from interventional dentistry towards preventive oral health within the hospital setting will undoubtedly assist in curtailting the burden of oral diseases in the community who should enjoy ready access to oral health care.

CONCLUSION

This study demonstrated that the prophylactic use of a chlorhexidine mouthrinse and amoxicillin in third molar surgery are equally effective in keeping postoperative infections to a minimum in medically competent patients. Indeed, a single dose of antibiotic prophylaxis failed to show any additional clinical advantage compared with the use of a chlorhexidine mouthrinse in reducing infections. Routine administration of prophylactic amoxicillin therapy in non-immunocompromised patients is therefore not recommended as the risks associated outweigh the benefits. A session of preoperative professional cleaning and a routine rinse with 0.2% chlorhexidine mouthrinse appears slightly more beneficial than antibiotic administration.

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The gingiva is often the site of localized growths that are considered to be reactive rather than neoplastic in nature. One of these gingival lesions, seen rather infrequently, is peripheral ossifying fibroma (POF) a condition that predominantly affects women and is usually located in the anterior maxilla. The lesions are pink to red in colour, and firm to hard in consistency depending on their bone content. As enlargement occurs, they may become ulcerated. Concurrent poor oral hygiene and early periodontal disease are commonly seen. In most cases there is no underlying bone involvement evident on the radiograph. The definitive diagnosis is established by histological examination, which reveals the presence of cellular connective tissue with focal calcifications. Surgical excision is the treatment of choice, though the recurrence rate can reach 20%. This article presents a case of POF in a 14 year old female, from whom the tumour was excised using electrosurgery.

Keywords: Peripheral ossifying fibroma, Electrosurgery, Interdental papilla.

INTRODUCTION
There are histologically different types of focal overgrowths which may occur on the gingiva such as peripheral giant cell granuloma, pyogenic granuloma, fibrous hyperplasia, and peripheral ossifying fibroma. These are usually the result of a reactive response to local irritation rather than neoplastic in nature. Many of these lesions can be identified as specific entities on the basis of characteristic morphology.\(^1\) One of the infrequently occurring gingival lesions is peripheral ossifying fibroma (POF) which is a focal, reactive, non-neoplastic tumour-like growth of the soft tissue typically seen on the interdental papilla and representing up to 2% of all oral lesions that are biopsied.\(^2,3\) Trauma or local irritants such as dental plaque, calculus, micro-organisms, masticatory forces, ill-fitting dentures and poor quality restorations have been implicated in the etiology of peripheral ossifying fibroma.\(^4\) POF mainly affects women in the second decade of life (50% of all patients being between 5-25 years of age). The lesions are most often found in the gingiva, located anterior to the molars and in the maxilla. Clinically, it manifests as a well-defined and slow-growing gingival mass measuring less than 2cm in size. The base may be sessile or pedunculated, the colour identical to gingiva or slightly reddish and the surface may appear ulcerated.\(^3\)

The definitive diagnosis is based on histological examination, with the identification of cellular connective tissue and the focal presence of bone or other calcifications. Surgery is the treatment of choice, though the recurrence rate can reach 20%.\(^3\) Also reported has been the opinion that POF represents a maturation of a pre-existing pyogenic granuloma or a peripheral giant cell granuloma.\(^5\) Surgical excision of the lesion can be performed by scalpel, electrosurgery or laser. Electrosurgical procedures have been employed in dentistry since 1928 for a variety of soft tissue applications owing to the primary advantage of providing a clear and blood-free operating field when compared with the use of the scalpel.\(^6\) Electrosurgery is the intentional passage of high-frequency waveforms or currents through the body tissues to achieve a controlled surgical effect. Intense intracellular heat is produced within the tissues contacted by the electrode tip, volatizing the cells. This leaves a path of cellular destruction in the form of an incision or surface coagulation.\(^7\)

Here, we present a case of POF diagnosed and treated at our hospital using electrosurgery.

CASE REPORT
A 14 year old female reported to the Department of Periodontology at RajaRajeswari Dental College & Hospital, Bangalore, with the chief complaint of a gingival swelling on the palatal aspect of the maxillary central incisors, which had been present for one month and was increasing in size. The swelling had started as a small nodule that progressed gradually to the present dimension. The patient did not give any history of trauma, injury or food impaction and there was no significant medical history.
An intraoral examination revealed a solitary, well-defined pedunculated growth measuring 1.5 × 1.0 cm on the palatal surface of the maxillary central incisors (Figure 1). The surface appeared slightly rough and erythematous. On palpation, the growth was not tender and was firm in consistency. No clinically evident ulceration was observed. The growth was not fixed to underlying bone. An occlusal radiograph did not show any abnormalities (Figure 2). Routine blood investigations were within normal limits. Following oral prophylaxis, it was decided to perform an excisional biopsy of the growth under local anesthesia using electrocautery.

An infiltration anesthesia of lignocaine containing 1:200,000 adrenaline was given in the area of interest. The electrocautery unit was set to cutting mode and the growth was excised en masse using the loop electrode with normal saline for irrigation (Figure 3). Haemostasis was achieved using the ball electrode in the coagulation mode (Figure 4). The specimen (Figure 5) was then transferred to a vial containing 10% formalin and sent for histopathological assessment. Prior to discharge, post-operative instructions were given to the patient with the advice to take analgesics should the need arise. The one-week recall revealed uneventful healing (Figure 6). No recurrence of the growth was observed during the two-month and 12-month follow up periods (Figures 7&8).

Histological examination revealed fragments of tissue lined by stratified squamous epithelium with areas of ulceration. The underlying stroma showed fibroblastic proliferation, calcification and bone formation. Osteoclast type giant cells were noted. Focally, mixed inflammatory infiltrate and congested blood vessels were seen (Figure 9). Based on the clinical and histological findings, the lesion was diagnosed as POF.
DISCUSSION

Intraoral ossifying fibromas were first described in the literature in the late 1940s. Many names have been given to similar lesions, such as epulis, peripheral fibroma with calcification, peripheral ossifying fibroma, calcifying fibroblastic granuloma, peripheral cementifying fibroma, peripheral fibroma with cementogenesis and peripheral cemento-ossifying fibroma. The sheen number of names used for fibroblastic gingival lesions indicates that there is much controversy surrounding the classification of these growths.6

There are two types of ossifying fibromas: central and peripheral. The central type arises from the endosteum or the periodontal ligament adjacent to the root apex and causes expansion of the medullary cavity. The peripheral type shows a contiguous relationship with the periodontal ligament (PDL) and occurs solely on soft tissues covering the tooth-bearing areas of jaws.2

The reasons for considering a PDL origin for POF include: exclusive occurrence of POF in the gingiva (interdental papillae); proximity of the gingival lesion to the periodontal ligament; presence of oxytalan fibers within the mineralized matrix of some lesions; age distribution, which is inversely related to the number of lost permanent teeth; and the fibrocellular response in POF, which is similar to other reactive gingival lesions of PDL origin.5 The existence of hormonal factors in the development of POF has been suggested in literature as the lesion has an obvious predilection for females and occurs frequently in puberty and pregnancy.5 Other factors implicated in its etiopathogenesis are trauma and local irritants such as dental plaque, calculus, microorganisms, masticatory forces, ill-fitting dental appliances and poor quality restorations.1,2

Gardner (1982) coined the term peripheral ossifying fibroma as describing a reactive proliferation exclusive to gingival mucosa.2,10 Although they are generally < 2 cm in diameter, the size can vary from 0.2–9.0 cm. The female to male ratio reported in the literature varies from 1.2:1 and 1.7:1 to 4:3:1. The majority of the lesions occur in the second decade, with a declining incidence in later years. POF appears to be more common among whites than blacks.8

The lesion may be present for a number of months to years before excision, depending on the degree of ulceration, discomfort and interference with function. Approximately 60% of POFs occur in the maxilla, and they occur more often in the anterior than posterior area, with 55%–60% presenting in the incisor-cuspid region.5

Gingival lesions that imitate POF are peripheral giant cell granuloma, pyogenic granuloma, fibroma and peripheral odontogenic fibroma. Other peripheral (extraosseous) lesions to consider are ameloblastoma, calcifying odontogenic cyst, and calcifying epithelial odontogenic tumor, but these are rare.10

The definitive diagnosis of POF is made by histologic evaluation of biopsy specimen. Histologically, the key feature of this lesion is an exceedingly cellular mass of connective tissue comprising large number of plump, proliferating fibroblasts intermingled throughout with delicate fibrous stroma. Buchner et al. observed that the mineralized tissues in POF can be bone, cementum-like material or dystrophic calcification.11 The surface of a POF exhibits either an intact or, more frequently, an ulcerated layer of stratified squamous epithelium. On occasion, areas will be found containing multinucleated giant cells that, with the surrounding tissue, bear considerable resemblance to some areas of peripheral giant cell granuloma.9

Radiographically, radiopaque foci are seen within the soft tissue mass if calcification is significant but in our case no such radio-opacities were observed, probably due to the fact that the lesion was of a short duration.5

Treatment requires proper surgical intervention that ensures deep excision of the lesion including periosteum and affected periodontal ligament.5 In addition, removal of local etiological factors such as bacterial plaque and calculus and attending to any identifiable irritant like an ill-fitting denture or rough restoration is essential.3,9 The teeth associated with POF are generally not mobile, though there have been reports of dental migration secondary to bone loss. Extraction of neighbouring teeth is usually not necessary.3

However, Walters et al. stated that total excision of the lesion in the maxillary anterior region can result in an unsightly gingival defect unless appropriate efforts are taken to repair the periosteal defects. Various plastic surgical techniques such as a laterally positioned flap, subepithelial connective tissue graft or a coronally positioned flap may be used to correct this defect and to minimize patient esthetic concerns.3,13 Chen et al. reported a case in which the gingival defect was satisfactorily covered using an artificial dermal graft.13

In our case report, the lesion was excised by electrosurgery. Notable advantages of electrosurgery over the surgical scalpel include: rapid dissection, precise tissue cutting with the self-disinfecting tip without use of manual pressure, immediate and consistent haemostasis that does not obscure the operative field, reduced overall operative blood loss, scar free wound healing,6,7 Atraumatic tissue cleavage and wound-sterilization eliminate the unfavourable postoperative sequelae common to scalpel surgery, contributing to rapid, uneventful postoperative healing.7 When compared with the dental lasers, electrosurgery has quite a few benefits as well. It exhibits a superior cutting efficiency while being significantly more economical than laser therapy. In addition, the electrode can cut on its side as well as the tip and can be angulated, thereby enabling easy contouring of the tissue especially in areas difficult of access.6 All of the above considerations made us choose electrosurgery as the preferred mode of treatment over the scalpel and laser. However, like all other equipment, electrocautery too has a few disadvantages including the need for preoperative anesthesia, unavoidable burning-flesh odour, low tactile sensitivity, greater thermal damage to surrounding tissues including bone. Electrosurgery cannot be used in patients with pacemakers or around implants.6,14

The recurrence rate of peripheral ossifying fibroma has been considered high for reactive lesions, with the average time interval for the first recurrence being 12 months.4,15 The rate of recurrence varies from 8.9% to 20%.6,16 It probably occurs due to incomplete initial removal, repeated injury or persistence of local irritants.4
POF can cause erosion of bone, displacement of teeth and interfere with or delay tooth eruption. Hence, early recognition and definitive surgical intervention can minimize the risk of tooth and bone loss.  

CONCLUSION
POF is slow growing, and asymptomatic and therefore the patient tends to seek treatment only when the lesion attains a size that hinders mastication or deglutition. A review of literature reveals that the lesion most frequently occurs in the maxillary incisor-cuspid region. POFs occur commonly in females with a peak incidence in the second decade of life. The lesion is a concern for the dental practitioner owing to its unclear etiology and high recurrence rate. As reactive gingival lesions in their initial stages are difficult to differentiate clinically, histopathological examination becomes essential for a definitive diagnosis. Treatment consists of surgical excision which can be accomplished by scalpel, electrosurgery or laser. In our study, electrosurgical excision of the POF yielded an excellent result with no recurrence observed at the 12-month follow up. Further, electrosurgery is superior to scalpel from the aspect of haemostasis and is cost-effective when compared with lasers. Healing is rapid and usually uneventful. On the basis of the above findings, electrosurgery can be considered as a promising alternative to scalpel or laser excision. We recommend long term follow up post excision due to the high propensity of POF for recurrence.

References
A 55-year-old male presented at the Oral Medicine Clinic of the University of the Western Cape, Oral Health Centre, Tygerberg Campus, for the evaluation of a persistent white patch on his right edentulous mandibular ridge. He had been referred from the Prosthodontics Clinic where he was seen for complete denture rehabilitation. The patient had no significant medical history and informed us that he had been smoking marijuana five times a day for more than twenty years and consumed alcohol occasionally. He had never worn a dental prosthesis and did not use tobacco in any form.

Extra-oral examination revealed bilateral submandibular lymphadenopathy and asymptomatic clicking of both temporomandibular joints during jaw opening. Intraoral examination showed completely edentulous upper and lower arches with a healing extraction socket in the posterior third quadrant. An asymptomatic, white homogenous plaque measuring 3x5mm, which could not be wiped off, was present on the crest of the right mandibular ridge (Figure 1).

Due to the small size of the lesion, an excisional biopsy was performed under local anaesthesia. Following the surgical procedure, the patient was prescribed 0.2% chlorhexidine digluconate oral rinse and 500mg Paracetamol four times daily.

Histological examination of the excised white plaque disclosed a fragment of squamous mucosa with acanthosis and hyperkeratosis (Figure 2). The subepithelial connective tissue was densely collagenized and showed a mild chronic inflammatory cell infiltrate. There was no evidence of dysplasia or malignancy in the histological sections examined. The Periodic Acid Schiff (PAS) stain was negative for fungal elements.

ACRONYMS

| LBC: | liquid based cytology |
| PMDs: | potentially malignant disorders |
| TB: | Toluidine blue |
| WHO: | World Health Organization |

Figure 1: A small homogenous white plaque on the right mandibular alveolar ridge.

Figure 2: The low power photomicrograph of the lesion seen in Figure 1 shows hyperparakeratosis of the surface epithelium (H & E, x 40). The fibrous connective tissue stroma exhibits mild chronic inflammation.
Evaluation of the biopsy site after two weeks showed complete resolution of the lesion. Based on the clinical and microscopic features, a diagnosis of non-dysplastic marijuana-induced oral leukoplakia was established. The patient was advised to stop smoking marijuana since there is a risk of possible malignant change. He was instructed to return to the clinic in six months for his periodic follow up visit.

DISCUSSION

Oral white lesions reflect many different diseases and pathological changes. Leukoplakia was first defined by the World Health Organization (WHO) in 1978 as a white patch or plaque which cannot otherwise be characterized clinically or pathologically as any other disease. A revised definition was proposed in 2007 by the WHO Collaborating Centre for Oral Cancer and Pre-cancer Working Group, in which leukoplakia was defined as “a white plaque of questionable risk, having excluded other known diseases or disorders, that carry no increased risk for malignant transformation.”

Worldwide, the estimated prevalence of oral leukoplakia is 1.7% to 2.7% for all age groups. Between 16% and 62% of oral squamous carcinomas are reported to arise from an area of oral leukoplakia, emphasizing the need for routine oral screening programs and regular monitoring of high risk individuals.

Globally, leukoplakias are reportedly diagnosed after the fourth decade of life and are six times more common among smokers than non-smokers. A clinical diagnosis of oral leukoplakia is made when a predominantly white lesion cannot be clearly diagnosed as any other disease or disorder of the oral mucosa. A biopsy is mandatory, since the differential diagnosis of leukoplakia is broad and may include oral lichen planus, pseudomembranous candidiasis, chemical injury, frictional keratosis, oral lichen planus, oral epithelial dysplasia and squamous cell carcinoma.

The most common aetiologic factor for leukoplakia is tobacco smoking, cessation of which may lead to regression or total disappearance of oral leukoplakia. A definite link between marijuana use and oral leukoplakia has not been established. Most studies of oral leukoplakia have focused on the role of tobacco as an aetiologic factor, since tobacco smoking is a more socially acceptable behaviour. In addition, the legal use of marijuana is restricted to certain countries.

More recently, marijuana use has been legalized in many states in America and some European countries. An American study found that marijuana use among adults in the United States has doubled in the last decade. In South Africa, the use of drugs such as marijuana, “tik” (metamphetamine) and cocaine is twice the global average and the highest in Africa.

Marijuana is derived from the macerated flowers of Cannabis sativa and contains the toxic compound A9 tetrahydrocannabinol (THC), a cannabinoid, which constitutes 1-6% m/v of the total weight of the plant flowers. In addition, more than 60 other cannabinoids have been identified in cannabis. When cannabis is smoked as marijuana, the resultant heat leads to aromatization of the cannabinoids and to carcinogenic substances such as polycyclic aromatic hydrocarbons, benzo[a]-pyrene, phenols, phytosterols, acids and terpenes, which are detectable in marijuana smoke. Marijuana thus carries the same carcinogens found in cigarette smoke and these carcinogens are known to cause DNA damage, which could potentially lead to malignant transformation.

In general, leukoplakias with dysplasia pose a higher risk for malignant transformation, compared with non-dysplastic leukoplakias. Several molecular biomarkers have been proposed, but currently, no single biomarker can accurately predict the potential for malignant transformation.

Currently, a range of non-invasive adjunctive diagnostic methodologies are available to screen oral potentially malignant disorders (PMDs), such as oral leukoplakias. These include vital staining techniques (using toluidine blue/tolonium chloride/lugol’s iodine), light based detection systems and exfoliative cytology.

Toluidine blue (TB) is a basic thiazine metachromatic dye, which stains tissues rich in nucleic acids because of its high affinity for acidic tissue components. Both dysplastic and neoplastic cells contain more nucleic acids than normal cells. TB-stained tissue may appear dark or pale royal blue and has been used for many years as an aid for the screening and post-surgical management of PMDs and oral cancer. It has been reported that TB staining could assist in early detection of oral cancer compared with conventional visual inspection alone. A systematic review revealed that TB has a sensitivity of 84% and a specificity of 70% and can be a valuable diagnostic tool in screening of large group of patients. A high percentage of false positive results have been associated with TB due to its ability to stain cells in benign hyperplastic and inflammatory lesions, which also contain large quantities of nucleic acids.

A number of light-based detection systems such as Vizilite, Vizilite plus, Microlux DL, narrow mission tissue fluorescence and the Veloscope, have been developed. The principle of these light-based detection systems is based on the fact that mucosal tissues undergoing inflammatory, abnormal metabolic or structural changes have different absorbance and reflectance profiles when exposed to various forms of light sources, enabling the differentiation of oral mucosal abnormalities. ViziLite shows high sensitivity (77%) and low specificity (28%) in detecting oral PMDs and oral cancer. Some studies found that ViziLite could not differentiate between keratotic or inflammatory oral PMDs and oral cancer. The ViziLite Plus combines the features of the Vizilite and TB and can further delineate ViziLite-positive lesions, thus improving its specificity as a diagnostic tool.

Exfoliative cytology is a quick and simple procedure based on a relativelyatraumatic semi-invasive technique, allowing for the collection of a rich concentrate of cells over a wider area than selective tissue biopsy and is ideal for use in large leukoplakic lesions. Recent cytologic techniques, such as liquid based cytology (LBC), have further improved the quality of oral cytologic smears. With LBC; the residual liquid based material can be used for immunocytochemistry and molecular testing.

Currently, none of the adjunctive diagnostic tests could be recommended as a replacement for scalpel biopsy and histopathological assessment. However, the use
of adjunctive tests (e.g. the use of Velscope to guide biopsies, and exfoliative cytology in large leukoplakic lesions), can further improve the overall accuracy of the histological assessment.

CONCLUSION
The current case report describes a unique case of marijuana-induced oral leukoplakia. With the increased use of marijuana in South Africa, a rise in marijuana-induced oral leukoplakic lesions may be expected. Dentists and oral hygienists should be aware of the possibility of marijuana use when confronted with oral leukoplakic lesions and their potentially malignant nature. The use of adjunctive screening tests may further improve the overall accuracy of histological examination.

References
Figures 1 & 2 are a case of a pleomorphic adenoma of the parotid gland affecting the right side. Pleomorphic adenoma, also known as a mixed tumour, is the most common benign tumour affecting salivary glands. It accounts for 60-70% of all salivary gland lesions. Growth of the pleomorphic adenoma is slow and painless. The onset of the disease is usually in the second to fifth decades of life. When a tumour exits in the secretory portion and is relatively large, it produces the typical sialographic appearance of the so-called “ball in hand” (Fig. 3). This finding is caused by a dislocation of and pressure on the duct resulting from a benign tumour with a capsule or pseudo capsule. The ducts appear to surround the tumour, which is accompanied by a filling defect in the gland parenchyma. Because of pressure by the tumour, the duct is extended, and the distance between furcations becomes longer. Interruption of the extended duct may also be present. Sialogram of pleomorphic adenoma of the left parotid gland (Fig. 4) shows dysfunction of the secondary ducts resulting from pressure of the tumour. Lateral view of the parotid sialogram shows the low density of the contrast medium (arrow). On CT and MR imaging pleomorphic adenoma appears as a round lesion with a distinct boundary line between it and the surrounding tissues. Sometimes its central part has a slightly lower density. The axial CT (Fig. 5 arrow) of a pleomorphic adenoma of the left parotid gland shows a round, encapsulated, well-circumscribed lesion. Computed tomographic sialogram of the same patient confirms the position of the tumour, (Fig. 6 arrow). Therefore CT sialography is very effective for the diagnosis tumour localization (topographic diagnosis). On ultrasonography; internal echoes are absent or homogeneous and weak. The posterior echoes are enhanced. Scintigrams show areas of decreased radioactivity and correspond to the neoplasm. Differential diagnosis may include Adenolymphoma (Wharton tumour) and Lipoma.

CJ Nortjé: BChD, PhD, ABOMR, DSc. Faculty of Dentistry, University of the Western Cape. E-mail: cnortje@uwc.ac.za

Reference
INTRODUCTION

A bite mark case was received from the Eastern Cape for analysis in the Department of Oral Pathology and Oral Biology. The evidence included a photograph of a bite mark on the left cheek of the victim, see Figure 1, two silicone impressions of the bite mark and a set of study models of the suspect’s dentition. Although the evidence proved to be sufficient for analysis, the recommended protocol for the collection of evidence was not followed. No American Board of Forensic Pathology (ABFO) rule or metric scale was used during the photographic session and the impression was extremely thin with no backing to maintain anatomical contours of the area bitten.

On examination of the evidence, several highly characteristic features were noted in the bite mark. The most relevant was the shovel shaped maxillary anteriors, showing the characteristic mesial and distal flaring. The other features that were clearly visible were the absence of the 22 and the anterior positioning of the 11 in relation to the 21. There were no recognisable dental features in the lower arch.

All the above mentioned features were present in the dentition of the suspect. After the macroscopic dental analysis of the bite mark and the suspect’s dentition, the case was sent to Silverton Forensic Laboratory for a tool mark and microscopic analysis of the evidence. The physical match as well as the microscopic analysis showed strong concordance between the suspect’s dentition and the bite mark present on the victim. The suspect was thus the most likely initiator of the bite marks found on the body of the deceased. For purposes of the court case, bite registrations of the suspect’s dentition were made by pressing the models of the suspect’s dentition into a plasticine clay, see Figures 2 & 3.

Two detailed forensic dental reports, one from each of the two authors, were submitted to the State Advocate for presentation in the High Court.

INTERESTING TURN OF EVENTS.

The forensic pathologist in the case was subpoenaed to appear several days before our appearance. During cross examination the forensic pathologist stated that the marks present on the left cheek were in fact post-mortem changes and definitely not bite marks. When the pathologist was asked to elaborate on his findings, he pointed to the

Figure 1: Bite mark present on the left cheek of the victim.

Figure 2: Plaster model of the suspect’s maxillary arch.

Figure 3: Bite marks of suspect’s dentition in the plasticine clay made by pushing the maxillary model into plasticine clay.

1. Herman Bernitz: BChD, Dip (Odont), MSc., PhD. (Pret). Department of Oral Pathology and Oral Biology, Faculty of Health Sciences, University of Pretoria.

Corresponding author
Herman Bernitz: Department of Oral Pathology and Oral Biology, Faculty of Health Sciences, University of Pretoria. E-mail: bernitz@iafrica.com

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marks posterior to the bite mark, misinterpreting them to be the bite marks described in our report, see Figure 4. The pathologist went into great detail describing how the marks could not be bite marks, considering the shape and size of the marks.

He was absolutely correct, as he was not describing the correct set of marks! The judge and state advocate were very relieved when we showed them that the marks pointed out by the forensic pathologist were in fact not the bitemarks inflicted by the suspect, but posterior to the real bite mark which the pathologist had overlooked, see Figure 5.

CONCLUSION

This case highlights the fact that only bite mark experts should examine bite marks. In his attempts to discredit our evidence, the forensic pathologist had homed in on the incorrect marks, present in the same area as the real bite marks. The bite mark evidence presented to the High Court was accepted and it can be reported that the suspect received two life sentences, one for rape and one for murder.

The names and places have been changed to protect the identities of the victim and of the forensic pathologist. Permission has been granted by the Department of Justice to present this information, as it is no longer sub judice.

References
The Medical School of the University of Arizona have developed a “Curriculum on Medical Ignorance” programme with which defines levels of knowledge. It is aptly called:

The Ignorance Map
There are six levels of knowledge:

**Known Unknowns:** all the things you know you don’t know.

**Unknown Unknowns:** all the things you don’t know you don’t know

**Errors:** all the things you think you know but don’t

**Unknown Knowns:** all the things you don’t know you know

**Taboos:** dangerous, polluting or forbidden knowledge

**Denials:** all the things too difficult, time consuming or painful to know, so you don’t

**INTRODUCTION**

A prosthodontist was recently called by a dentist who was asking for advice about a patient who was anaesthetized and lying in the chair at that time. The patient was partially dentate in the mandible, with severe periodontal disease and over-eruption of the remaining six anterior teeth. These were opposed by a complete maxillary denture. The patient had been unable to tolerate a mandibular partial denture resulting in development of a classical combination syndrome. The dentist planned to extract the remaining teeth and at the same time insert six implants in each arch. These were going to be immediately loaded with complete over-dentures, and later restored with two fixed implant supported prostheses. As a new implant system was to be used, the company representative had volunteered to assist with the instrumentation, componentry and surgical placement. However, once the teeth were extracted, neither the dentist nor the representative could decide on the best position, length and diameter implants to use in each arch. They were also concerned that the anterior maxillary ridge seemed to be severely resorbed and flabby, while posteriorly it was enlarged and encroaching on the restorative space.

This scenario is neither fictitious nor is it an isolated occurrence. Many clinicians are attending short courses or subscribing to internet sites which provide virtual “hands-on” demonstrations and training using new materials and techniques. They are then embarking on complex treatment without ever having previously carried out these procedures, and in fact are using their own patients as “learning material”. This raises countless professional, ethical and legal concerns regarding the behaviour of the dentist, the welfare and rights of the patient, the responsibilities of those teaching or being consulted for advice, as well as the issue concerning company representatives. Focus questions and concerns will differ with each situation. However the above scenario will be used as an example in highlighting how many aspects potentially could be involved, and, indeed, should have been considered.

**a. Issues and questions related to the clinician:**

- Was the oral hygiene status assessed and education given before considering any rehabilitation? If not, any prosthesis is destined to become a “plaque applicator”
- Was there any attempt to address the periodontal condition before extractions? It has been shown that pre-existing periodontal disease predisposes a patient to subsequent peri-implantitis.
- Why were no diagnostic dentures made to assess tooth position, arch form and patient adaptation?
- Why was there no surgical stent to guide implant placement?
- Had the patient been sent for CT scans to assess available bone quality and quantity?
- What levels of pre-operative planning had been carried out?
- Had the dentist considered the implications of immediate loading?

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1. Leanne M Sykes: BSc, BDS, MDent (Pros), Dip Res Ethics (Irensa), Dip Forensic Odont. Department of Prosthodontics, University of Pretoria.
2. Z Vally: BDS, MDent (Pros). Department of Prosthodontics, University of Pretoria.

**Corresponding author**
Leanne M Sykes:
Department of Prosthodontics, University of Pretoria.
E-mail: leanne.sykes@up.ac.za

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• Was the patient informed that the interim dentures were diagnostic and as such would be removable, and would need to be replaced at a later stage (with costs)?

• Were there any anatomical limitations that could have impacted on the definitive prosthesis, necessitating it to also be restored with removable rather than fixed option? For example: Had the dentist considered the biomechanical forces that would be exerted on the prosthesis and whether there was sufficient bone to handle these forces? Had the inter-arch distance been measured as this space dictates the type of prosthesis that can be accommodated? Both of these will have a direct bearing on the treatment options and associated costs.

• Was the patient informed of his/her rights to seek a second opinion before embarking on such extensive treatment?9

• Was the dentist’s level of training and scope of expertise adequate to ensure competency in both the surgical and prosthodontic aspects of this treatment?

• How can the dentist justify using a system without being fully acquainted with it, and adept at using its components?

• Had the patient been informed of all the cost and time implications? Many patients are unaware that they will need to pay for surgical as well as restorative components, laboratory charges, clinician fees, and that they may require an interim and definitive prosthesis.

• Who would handle complications if they arose? Was the dentist able to do this?

• Was there a back-up plan should any implants fail for whatever reason?

• How would the situation be handled if the implants were not in the correct aesthetic or functional position after placement?

• Had there been any consideration for the occlusal scheme that would be used?

• How had the combination syndrome been addressed in terms of the occlusal plane discrepancies, the flabby anterior maxillary tissue and lack of bone, the bulbous maxillary tuberosities, the resorbed posterior mandible and the reverse occlusal plane of the mandibular arch?5

If I don’t know I don’t know - I think I know!

b. Issues and concerns for the consultant

• Does the prosthodontist / third party have the right to caution the dentist not to proceed, and if so how do they go about doing this?

• If the dentist still insists on proceeding, does the prosthodontist / third party have an ethical obligation to try help for the sake of the patient in order to prevent possible harm?6

• Is it ethical to refuse to help, but do nothing to prevent the dentist from proceeding?

• If the prosthodontist / third party don’t help, how could they warn the patient of their concerns given that they do not know the identity of the patient? In addition, if they did manage to make contact with the patient, could they be indicted for defamation of character?

• Can they be held accountable because of their implicit knowledge of the situation?

• If complications arise, could the patient lay charges against them because of the advice they offered?

• What will happen to the patient if the dentist does agree to stop the procedure? The teeth had already been extracted and the patient was anaesthetized

• Can the dentist be reported to HPCSA? If so on what grounds as no wrong had yet been done, and it would be difficult to prove that the latter is not capable to carry out this procedure

• Who, where, when and how does a clinician report a colleague?

c. Legal implications, and conflicts of interest when company representatives act as advisors:

• Is a representative legally allowed to be assisting in surgery as well as training clinicians? What is their scope of practice and are there limitations to their involvement?

• Are the representatives accountable for failures if they have been involved in the clinical aspects of treatment, or will they only take responsibility for defects with their components?

• To whom are representatives accountable, who oversees their actions, and to whom can they be reported to if they overstep the boundaries?

• Do they have unbiased peer-reviewed literature to back up their products or is it based on company sponsored research?

• What literature was available to justify using the new system? Has it been tested clinically, and are there long-term follow up studies?

• Is the patient aware that a new system is being used, and that those promoting it may have a conflict of interest? This is often concealed and patients are enticed by being offered components at a “special” rate.

• What follow-up guarantees do the company extend to patients?

DUTIES OF CARE

The Online Medical Dictionary defines clinical treatment as “the management and care of a patient by provision of therapy focused on combatting a disease or disorder, or with interventions aimed at improving health.” The clinician usually follows accepted standards, aims to provide a therapeutic benefit to the patient, and has an expectation of success.7 When a patient consents to dental treatment, the agreement is based on an expectation that the dentist is competent, that the materials have been approved by the appropriate authorities, that the techniques are recognized and accepted in the scientific community, and that the results will achieve the desired outcomes.8

Problems arise when a clinician knowingly decides to “test out” a new material or procedure, or to carry out work that is beyond his/her expertise and scope of training.7 Dental specialists have to complete an accredited training programme and thereafter limit their practice exclusively to this specialized area.4 However, general dentists do not have to adhere to these restrictions and can undertake work in any aspect of dentistry they choose. In this situation, because of the dentist’s inexperience and lack
of training, the patient could be subject to extended surgical time and discomfort, more pronounced post-operative morbidity, potential implant or prosthesis failure, wasted time and money, and even possible catastrophic complications.

At the same time much industry-sponsored research is being carried out in the private sector with patients becoming “research subjects”. They are often offered sponsored products in order for manufacturers to boost their sales and redistribute their market share. This may act as an undue influence, which could cloud the patient’s judgement and undermines the ethical protection of free and informed consent. Dentists may knowingly or unwittingly promote the product for their own interest, which can be construed as either soft or hard paternalism. Thus, dentists are obliged to reveal verbally and in writing whether they have any financial interests in institutions, diagnostic equipment and by extrapolation products they may be promoting.

Currently many general dentists are undertaking various short training courses, including those offered by recognized teaching institutions, informal study groups, and dental companies. In addition many have begun using social media to communicate with colleagues as well as other web-based sites for professional development. Applications such as YouTube are saturated with videos offering practical “hands-on” training tutorials. However, one has to question how well this virtual reality reflects the actual clinical situation and if it is adequate to equip dentists to carry out the procedures on their own patients? There will need to be effectiveness studies to test out the value and usefulness of SM training before it can convincingly be accepted as a “practical” practical educational alternative. The same questions may apply in cases where Tele-dentistry offers remote provision of dental care, advice or treatment using information technology. Who is responsible for establishing the patient’s personal, social, medical and dental history? Who should conduct the clinical examination? What other tests have been carried out? Who is custodian of the records? And who is accountable for complications that may arise after a procedure, the clinician who carried out the work or the colleague who gave the advice?

RECOMMENDATIONS

The Health Professions Council of South Africa (HPCSA) clearly outlines core ethical values and standards of good practice which include acting in the best interest and well-being of the patient, being truthful, and allowing patients to make autonomous, informed decisions regarding their own oral health. It also acknowledges that while practitioners should continually strive for self-improvement and endeavour to gain the highest levels of knowledge and skills, they should also be cognizant of their capabilities and skills, and only practice within their areas of expertise. However, as professionals, in addition to their ethical and moral obligations, they also have legal duties to follow procedures and to use recommended skills when dealing with patients.

This raises the issue of how the third party should handle a colleague who “Doesn’t know, doesn’t know they don’t know, or thinks they do know!”

The guidelines regarding interactions between contemporaries are less explicit. Health-care practitioners are expected to refrain from speaking ill of colleagues, to not make patients doubt the knowledge or skills of their clinician, and to work with other professionals in pursuit of the best care for all patients. They also have a duty to advise those who are impaired to seek professional help and to report unprofessional, illegal or unethical conduct.

However, a dentist practicing outside his/her scope is not impaired per se, and is not necessarily acting unethically or illegally, which puts the third party in an awkward position. There is also the added dilemma that they have a very real concern that the patient is at risk, but no damage has yet been done. When faced with such issues ethical, moral and altruistic reasoning should prevail. The prosthodontist should try to advise and caution the dentist against proceeding, and suggest that the patient be referred to someone more experienced. If necessary, and feasible, they may even offer to take over certain aspects of the treatment – patient willing. Importantly, failure to voice concern could be seen as complicity. If the dentist does not take heed of the advice, the third party should raise a concern with the HPCSA. This will offer protection if the treatment fails and there are repercussions, and may prime the Council to be attentive to repeated reports or complaints from other practitioners or patients.

The General Dental Council consider it an obligation for dental professionals to take protective measures and raise a concern if they consider patients or colleagues to be at risk. They offer valuable advice on when and how to raise a concern. Note that a concern is not a formal complaint but rather providing information about something that is believed to be putting others at risk. In Dentistry, it relates to any matter that may pose a risk for patients or for other colleagues. It could be related to the health, behaviour or professional performance of a colleague; any aspect of the clinical environment where treatment is provided; where a practitioner has been asked to do something that conflicts with their duties to put their patient’s interest first; where there is a suspected wrongdoing without the person having actually witnessed it; or where there is a risk for patients but nothing has yet happened. Sometimes it is difficult to act because of feelings of loyalty, fear of victimization, being subordinate to the offender or merely being unsure of who to approach. Some self-directed questions may help with this decision. Consider whether you would be concerned if this person was treating a family member; their behaviour was repeated; they have a health or dependency issue; their actions are putting others at risk; whether you can justify not raising the concern; and what may happen in the short and long term if the concern is not raised.

On the other hand, if the offending dentist is reasonable and receptive, a more philanthropic approach would be to avoid direct confrontation and accusation and rather try to educate the dentist as to possible shortcomings and ineptitude. The dentist may also be directed to reputable channels the requisite knowledge and skills may be gained.

The one outstanding issue for which there are no clear guidelines or directives is that of the representatives...
offering advice and training. Can they be reported? To whom? And how? As yet there does not appear to be any legal channel to address this.

*He that knows not, and knows not that he knows not, is a fool.*
*Shun him.*

*He that knows not, and knows that he knows not, is a pupil.*
*Teach him.*

*He that knows, and knows not that he knows, is asleep.*
*Wake him.*

*He that knows, and knows that he knows, is a teacher.*
*Follow him.*

(Arabic proverb)

References
1. Light-curing units used in Dentistry: factors associated with heat development—potential risk for patients


Light curing is a critical step in the restorative process when using light-activated resin-based composites, but it is frequently not given the attention it deserves. Often, imprecise terms such as high-power, high-intensity or high-irradiance are used to describe a curing light. The term radiant exitance (expressed in units of mW/cm²) is the correct term to describe the output from a curing light and is the power emitted by the light source divided by the area of the light tip that emits light. Another important piece of information is the emission spectrum in nanometers of the emitted light. The irradiance (also expressed in units of mW/cm²) is the radiant power incident on a surface and describes what the resin receives. The radiant exposure is the radiant energy applied to a given surface area over time (irradiance × time = energy/area = J/cm²). Unlike lasers, different dental LED LCUs (Light emitting diode [LED] light curing units [LCUs]) vary greatly in the extent to which they are collimated or can maintain irradiance with distance and irradiance figures described by manufacturers are often inaccurate because they are almost universally established at zero source distance which is not clinically relevant. Irradiance is greatly affected by the tip diameter and light dispersion with distance from the light tip. Irradiance may also vary greatly across different regions of the light guide exit window. The power output (in watts) from the unit is a more useful measure of how powerful the LCU is because a high irradiance can still be achieved simply by using a small tip. Dentists should recognize that the manufacturer-stated LCU irradiance value is rarely achieved when the LCU is positioned at a clinically relevant distance of 4 mm or more away from the resin. Thus, the material minimum energy requirement of the resin is often not achieved when LCU manufacturer directions for use are followed.

Photopolymerization dominates using blue light of a wavelength between 380 and 500 nm and with an irradiance of >450 mW/cm². During the last 10 years, LCUs employing LED technology have largely taken over from the older quartz-tungsten-halogen (QTH) devices. LED is considered as “cold light” created by recombination of electrons using crystals (e.g., GaN) releasing photons (i.e., light) when subjected to energy (i.e., voltage). The advantage of LED is a spectrum closer to the point for photoexcitation of the most widely used photoinitiators in dental resin-based composites (RBCs). In addition, use of energy is more efficient (i.e., more light and less heat). In recent years, light-curing units employing LED-LCU with higher energy output than previous generations of LCU have emerged on the market. The reason for this development trend is claimed to be shorter curing times and increased polymerization. With higher output, there is a risk of increased temperature even with LED technology and concerns have been raised about increasing risk for pulp and tissue damage in patients. Complaints from patients in connection with light-curing procedures have been reported, including experience of “burning” sensations in teeth and in oral tissue.

Different brands of LED-LCU with the same expected output do not always produce the same amount of heat, and this may be due to differences between the light in spectral distribution, the type of LED-LCU tip used and its diameter, and/or the use of a fan in the LED-LCU. In addition to the heat produced by the LED-LCU, the polymerization of the composite (i.e., exothermic reaction) has been discussed as causes for tissue damage (i.e., pulp damage). The light source is still, however, considered to be the main risk even though the composite and the remaining dental hard tissue may give some protection.

Mouhat and colleagues (2017) reported on a study that sought to develop a reliable bench model for investigating how heat development in the pulp chamber and coronal surface of natural teeth with and without cusps and subjected to irradiance using three different LED-LCUs is associated with (i) irradiance, (ii) time, (iii) distance, and (iv) radiant exposure (product of irradiance and time which represent the total light energy delivered to the resin based composite).
MATERIALS AND METHODS

Two different brands of LED-LCUs were tested, Bluephase style® and Bluephase G2®. One LED-LCU Bluephase G2® was tested in two modes (high mode and low mode). Two LED-LCU Bluephase style® were tested, one battery powered and one mains powered.

Bluephase style® (n = 10) and Bluephase G2® (n = 10) (IvoClar/Vivadent) were tested for irradiance using a calibrated laboratory-grade spectrometer. The objective was to evaluate eventual differences in irradiance among the curing unit within the same brand. The LED-LCU were battery powered, the batteries being fully charged on all test occasions. The working capacity of the LED-LCU lithium-polymer battery for the two brands of LED-LCU is ≈80 min. Bluephase G2® was tested in high mode. One Bluephase style® was also tested when connected to main electricity. Caution was taken in the precise placement of the TIP on the sensor of the measurement equipment. To achieve this, an adjustable precision gantry with a 0.1-mm scale was used/ (#55025, Edmunds Optics, Barrington, NJ). For evaluation of differences among units in the same brand, five measurements for each unit at 0-mm distance were conducted at irradiation times of 10, 20, and 30s, respectively. The variation in irradiance was small for nine of the ten units in the same brand. One of these nine units for each brand was randomly selected for the temperature profile experiments.

For the temperature profile experiments, caries-free human third molars were used. The teeth were extracted for surgical reasons, not more than six months previously. They had been stored in 0.5% chloramine-T solution in a refrigerator (4 ± 1°C) prior to use. In one tooth (T1), a class I cavity was prepared with a cylindrical diamond (D=1.2mm) bur through the enamel and into the dentin. The apex of the root was cut and the channel prepared up to the pulp chamber with K-files 35 and 70. The tip of a thin (0.2mm) type T (copper constantan) thermocouple was inserted into the pulp chamber via the prepared channel, and its position was controlled with radiography. The remaining pulpal wall had a thickness of 1.3 ± 0.2mm as assessed from the radiograph. In order to avoid an air space surrounding the tip of thermocouple inside the pulp chamber, the prepared channel was filled with glycerol prior to insertion of the thermocouple. The excess glycerol (spillage) during insertion was removed. Glass Ionomer (Fuji I®) was used to seal the apex and secure the thermocouple.

A second tooth (T2) was cut in the horizontal plane using a diamond saw, creating a flat dentin surface with a pulpal wall thickness of approximately 0.6 mm. Radiography was also used to control placement of the thermocouple and thickness of the dentin wall as described above.

In an attempt to simulate as closely as possible the thermal conditions within the oral cavity, a special experimental rig was constructed involving the use of a thermostatically controlled circulating water bath maintained at 37 ± 1°C. The individual tooth under investigation was inserted approximately halfway (at the cemento-enamel junction) through an opening in the centre of a 75 × 50 × 1.25mm-thick plastic sheet, in such a way that the root was visible on one side and the crown on the other. The edges of the plastic plate were in turn glued to one side of a 12mm-thick sheet of expanded polystyrene that had a rectangular-shaped opening with slightly smaller dimensions to the plastic plate. The plastic plate was attached to the polystyrene plate with the coronal side of the tooth situated within the open space of the polystyrene plate. This combined unit was then positioned on the water surface inside the thermostatically controlled circulating water bath, such that the root was immersed below the water surface and the coronal part in the air. A second thermocouple was placed in the air space ≈2 mm from the coronal side of the tooth for measuring the air temperature in the immediate vicinity of the tooth.

The surface temperature of the tooth was measured by thermography using a high-precision infrared camera with a close-up lens. For temperature measurements, the two LED-LCUs chosen from the irradiance test were tested at the following combinations of curing time and distance from the tooth surface (10, 20, and 30s and 0, 2, and 4mm, respectively). The curing times chosen are within the range recommended by the manufacturers. The chosen distances of the tip from the tooth were based on those generally used in a clinical setting. For Bluephase G2®, the tests were performed both in low (≈700 mW/cm²) and high modes (≈1400 mW/cm²). Five repeated measurements for each distance/time combination were performed. All temperature data were continuously recorded before, during, and after a simulated curing cycle. Between each measurement, a recovery time was allowed to make sure that the temperatures had returned to its baseline value (pre-irradiation value).

RESULTS

The mean values of irradiance of ten Bluephase style® LED-LCU and mean value of ten Bluephase G2® LED-LCU were statistically significantly different. There was also a significant difference in irradiance with time within the ten Bluephase style® units

The mean (SD) for the irradiance of the two different light-curing units tested, Bluephase style® battery (n = 10) and Bluephase G2® high mode (n = 10), at three different curing times are shown in the table below:

<table>
<thead>
<tr>
<th>Curing time</th>
<th>Irradiance of Bluephase style® battery in mW/cm²</th>
<th>Irradiance of Bluephase G2® high mode in mW/cm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 s</td>
<td>1337 (104) side</td>
<td>1411 (142) a</td>
</tr>
<tr>
<td>20 s</td>
<td>1477 (240) bd</td>
<td>1362 (121) b</td>
</tr>
<tr>
<td>30 s</td>
<td>1479 (96) ce</td>
<td>1382 (102) c</td>
</tr>
</tbody>
</table>

The letters a-c indicate significant differences (p < 0.05) between Bluephase G2® and Bluephase style® at the different times tested respectively. The letters d-e indicate significant differences (p < 0.05) in irradiance at different times for Bluephase style®. Wavelength for the two light-curing units was 385–515 nm.

The irradiance was higher than claimed from the manufacturer for the majority of the units tested. For Bluephase style®, the claimed maximum irradiance was 1100 ± 10 mW/cm² and for Bluephase G2® 1200 ± 10 mW/cm². The temperature distribution on the surface of the tooth (T1) was non-uniform compared with T2. The increase in pulp chamber temperature was less for T1 compared with T2. The maximal surface temperature was 58.1 ± 0.9°C (for T2 at 2mm distance, 30s curing time), and the maximal pulp chamber temperature was 43.1 ± 0.9°C (for T2 at 0mm, 30s curing time).
For both T1 and T2, radiant exposure was shown by multiple regression analyses to be the most important factor for heat development. For T1, 69% of the variation of the surface temperature and 75% of the pulp chamber temperature were explained by radiant exposure. For T2, the outcomes were 47% (surface temperature) and 62.5% (pulp temperature), respectively. Since radiant exposure is calculated as a function of watt x time/area, time will still be the most important factor on the temperature variation. When the different LED-LCUs and curing modes were compared (Bluephase style® electrically powered, Bluephase style® battery, Bluephase G2® high mode, and Bluephase G2® low mode), multiple linear regression analyses similarly showed that time was the most important factor for the temperature variations on T2.

An increase in surface temperature with increasing distance from 0 to 2mm was seen for all LED-LCUs. For the Bluephase G2®, this was also seen when the distance was increased to 4mm, irrespective of the mode used. Even though the irradiance (and radiant exposure accordingly) was lower at 2mm distance for the Bluephase G2® high mode, the surface temperature increased (52.2 ± 0.6°C at 2mm vs. 46.9 ± 1.2°C at 0mm) when irradiated for 30s. For the same unit in low mode and for the Bluephase style® battery tested, the recorded increase in surface temperature followed the increase in irradiance (and radiant exposure accordingly) at different distances.

CONCLUSION
The researchers concluded that increased curing time seemed to be the factor most likely to cause temperature rise. When the tip is close to soft tissue, the risk of damage should seriously be taken into account at irradiances >1200 mW/cm². There is also a risk of pulp damage when only thin dentin is left at higher irradiances. Decreased curing time may reduce the risk for soft and pulpal tissue damage but this can have a negative effect on the degree of conversion.

IMPLICATIONS FOR PRACTICE
The findings of this study highlight the importance of considering factors that can cause overheating and subsequent damage to viable tissue both within the pulp chamber as well as in tissue surrounding the tooth when using LED-LCUs. Risk of superficial tissue damage at irradiances >1200 mW/cm² is evident. There is a risk of pulp damage at higher irradiances (>1200 mW/cm²) and Acronyms when only thin dentin is left. Clinicians should be aware of LED-LCU settings and possible high temperatures generated.

References

2. The accuracy of digital impressions of multiple dental implants.


The introduction of CAD/CAM has simplified and improved the workflow of fixed prosthodontic dentistry. Many modern dental practices have introduced CAD/CAM technology into their rooms and these have been shown in a number of studies to significantly improve the accuracy of prosthetic frameworks compared to conventional cast frameworks. In the conventional workflow, half of any misfit is introduced during the impression procedure and production of the stone cast, while the other half occurs while manufacturing the prosthesis. Although CAD-CAM improved the accuracy of the latter, the initial step in the workflow, making an impression and pouring the cast, remained the same.

Making a digital impression by means of an intra-oral scanner may help to overcome these errors. The virtual model used by the CAD software is almost immediately created using the data of the intra-oral scanner. As there is no need for a stone cast or a conventional impression, the dimensional errors that take place during these procedures can be avoided. Theoretically, this could improve the accuracy and fit of the final prosthesis. According to many authors, discrepancies up to 150 μm were acceptable.

For implant-supported reconstructions, the level of fit is even more important compared with teeth-supported prostheses. Dental implants have a reduced mobility which only exists because of the flexibility of the bone. The absence of a periodontal ligament prevents the implant from adapting to the ill-fitting framework, and as a consequence, stress will be induced in the implant and framework.

Making digital impressions of dental implants requires the use of scanbodies, which are easy to capture as most of the object is located supragingivally. Scanning an edentulous jaw may be challenging due to the lack of anatomical landmarks and the fact that all scanbodies are identical. Some researchers experienced several problems when scanning two implants in the edentulous mandible because the intra-oral scanner had difficulties in making a distinction between both implants. As a result, the majority of scans were useless.

Vandeweghe and colleagues reported on an in vitro investigation that sought to evaluate the accuracy of various intra-oral scanners when used for implant impressions in the edentulous jaw.

MATERIALS AND METHODS
Six regular dental implants with an external hex connection (IBT, Southern Implants®, Irene, South Africa) were placed in an acrylic model of the edentulous mandible at the position of the 1st molar, 1st premolar and lateral incisor. Inter-scan body distance and angulation are depicted in...
The model was scanned in a similar manner 15 times by each intra-oral scanner according to the manufacturer’s recommendations. The first five scans were not used for analyses, to avoid inaccuracies caused by a learning curve. The remaining scans were exported to an open file format (STL, PLY). For the Lava COS and 3M TrueDef, these files could be downloaded directly from the cloud, while for the 3Shape Trios and Cerec Omnicam, the data had to be imported into additional software to allow creation of an open STL file.

The Lava™ Chairside Oral Scanner (Lava COS) was launched in 2008 by 3M™ESPE (Seefeld, Germany) and is based on the principle of active wavefront sampling with structured light projection. It allows data capturing in a video sequence and models the data in real time. Light powder dusting of the dental arch is necessary to locate reference points for the scanner.

In 2012, the Lava COS was replaced by the 3M™ True Definition (3M TrueDef) scanner (3M™ESPE), which is an upgraded version of the Lava COS, with updated software and an improved wand with a larger focus depth. It also uses light powder dusting.

The Cerec Omnicam (Sirona, Long Island City, NY, USA) is based on the concept of active triangulation and uses a white light to project a pattern on the object. It captures data continuously in colour, without the need for contrast spraying.

The Trios scanner (3Shape, Copenhagen, Denmark) is based on confocal microscopy and continuously captures 2D images from different positions to create a 3D surface. The recent version captures in colour and does not use contrast spraying.

All scans were imported into metrology software (Geomagic Qualify 12, 3D Systems, Rock Hill, SC, USA) for data analyses. The CAD file of the scan body was aligned to the six scanbodies, using a best-fit algorithm with the tolerance set at 1 μm. Next, the six aligned scanbodies were saved as a new file.

Accuracy consists of two parameters: trueness describes how close a test scan resembles the scan taken by a reference scanner, while precision describes how much the various test scans differ from each other.

For this study, the trueness was evaluated by comparing the various test scans obtained from the intra-oral scanner with the reference scan from the Imetric 104i. Precision was evaluated by comparing the scans from each intra-oral scanner with one another. The primary outcome is thus to evaluate the accuracy, in terms of trueness and precision, at the level of the implant scanbodies.

<table>
<thead>
<tr>
<th>Scan body</th>
<th>Angle</th>
<th>Distance, mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>46–44</td>
<td>0.57°</td>
<td>9.51</td>
</tr>
<tr>
<td>44–42</td>
<td>1.65°</td>
<td>6.61</td>
</tr>
<tr>
<td>42–32</td>
<td>4.62°</td>
<td>10.28</td>
</tr>
<tr>
<td>32–34</td>
<td>4.79°</td>
<td>7.28</td>
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<tr>
<td>34–36</td>
<td>4.22°</td>
<td>5.70</td>
</tr>
</tbody>
</table>

Table 1: Overview of the distance and angle between the adjacent implant scanbodies

Test and reference scans were superimposed and aligned, using a best-fit algorithm with the tolerance set at 0.001 μm. Then, a 3D comparison was done, thereby calculating the absolute mean deviation from the mean positive and negative deviation. The trueness was based on 10 comparisons per scanner, while the precision was calculated from 45 comparisons.

Differences in trueness and precision were first evaluated using Friedman’s 2-way ANOVA test. Post hoc analyses to identify significant differences in trueness and precision in between the different intra-oral scanners were done using Wilcoxon signed rank test.

RESULTS
Mean values for trueness and precision were based on the analyses of the pooled findings for all six scanbodies. Friedman’s test detected significant differences for trueness (P < 0.001) and precision (P < 0.001)

The mean trueness was 0.112mm (SD 0.025, range 0.084–0.174) for Lava COS, 0.035mm (SD 0.012, range 0.023–0.061) for 3M TrueDef, 0.028mm (SD 0.007, range 0.021–0.044) for 3Shape Trios and 0.061mm (SD 0.023, range 0.029–0.099) for Cerec Omnicam. There was no statistically significant difference between 3M TrueDef and 3Shape Trios (P = 0.262). Cerec Omnicam was less accurate than 3M TrueDef (P = 0.013) and 3Shape Trios (P = 0.005) but more accurate compared with Lava COS (P = 0.007). Lava COS was also less accurate compared with 3M TrueDef (P = 0.005) and 3Shape Trios (P = 0.005).

The mean precision was 0.066mm (SD 0.025, range 0.001–0.132) for Lava COS, 0.030mm (SD 0.011, range 0.013–0.054) for 3M TrueDef, 0.033mm (SD 0.012, range 0.005–0.057) for 3Shape Trios and 0.059 mm (SD 0.024, range 0.009–0.115) for Cerec Omnicam. There was no statistical significant difference between 3M TrueDef and 3Shape Trios (P = 0.119). Cerec Omnicam was less accurate compared with 3M TrueDef (P < 0.001) and 3Shape Trios (P < 0.001), but no difference was found with Lava COS (P=0.169). Lava COS was also less accurate compared with the 3M TrueDef (P < 0.001) and 3Shape Trios (P < 0.001).

CONCLUSIONS
According to the literature, discrepancies up to 150 μm will not induce clinical complications. However, some authors put this threshold a lot lower, between 50 and 75 μm - hence, based on these numbers, one can conclude that Lava COS cannot be used to take digital impressions for a large-span implant-supported construction. The other scanners demonstrated a level of accuracy (trueness and precision) which seems clinically acceptable. Consequently, clinicians should be aware that not every intra-oral scanner can be used for every indication.

IMPLICATIONS FOR PRACTICE
Clinicians should be aware of the limitations of the intraoral scanners, especially in terms of the accepted threshold for discrepancies which ranges from 50-150 μm for clinical acceptability.

Reference
GENERAL

Planning for Financially Independent Retirement (p 204)
1. A recent survey found that amongst South African households the following percentage had sufficient funds to retire as financially independent:
   a. 10%
   b. 23%
   c. 4%
   d. 17%
2. What percentage of respondents in the survey younger than 30 years of age were not involved in retirement planning?
   a. 15%
   b. 17%
   c. 20%
   d. 43%
3. Swart proposes that financially secure retirement before the age of 65 requires a fund of at least 12 times the annual gross salary.
   a. True
   b. False
4. The three crucial steps when planning for retirement are: establish retirement goals; determine the required amount; prepare an appropriate investment portfolio
   a. True
   b. False

An assessment of the accuracy of a panoramic radiograph as compared with cone-beam tomography in TMJ imaging (p 209)
5. TMJ joint space was found in this study to range between 1mm and 10 mm.
   a. True
   b. False
6. The statistically determined Levels of Agreement by the Bland and Altman method were in close accord.
   a. True
   b. False

Impacted mandibular third molars: the efficacy of prophylactic antibiotics and chlorhexidine mouthwash in preventing postoperative infections (p 213)
7. Prophylactic preoperative antibiotic therapy is more effective in reducing postoperative infections compared with a preoperative chlorhexidine mouthrinse in mandibular third molar surgery?
   a. True
   b. False
8. Which of the following is NOT true with regards to chlorhexidine gluconate mouthwash?
   a. It has a broad spectrum of activity against both gram positive and gram negative bacteria.
   b. The development of resistance to the microorganisms it affects is not a major concern.
   c. It cannot be safely used in pregnant or lactating women
   d. It assists in the reduction of post extraction infections by reducing the oral bacterial load at the surgical site.
9. Identify the CORRECT statement:
The routine prescription of antibiotic prophylaxis in mandibular third molar surgery:
   a. does not lead to the development of antibacterial resistance
   b. cannot result in anaphylaxis and toxicity
   c. is uncommon among dental practitioners
   d. is a controversial practice
   e. is not contraindicated in pregnant women
10. Identify the CORRECT statement.
    When selecting and prescribing an antibiotic for prophylaxis in third molar surgery:
    a. The bacteria present at the operative site do not influence the choice of the antibiotic
    b. The antibiotic with the largest antibacterial spectrum must be used.
    c. The lowest dosage of drug must be administered.
    d. The timing for the administration of the drug is unimportant.
    e. The exposure time must be as short as possible.

Electro-surgical management of a peripheral ossifying fibroma (p 220)
11. The most common site of occurrence of peripheral ossifying fibromata is the gingival tissue around:
   a. Incisor/Cuspid
   b. Premolar
   c. Molar
   d. No site predilection
12. Identify the INCORRECT statement. Factors that play a role in the aetiopathogenesis of peripheral ossifying fibromata are:
   a. Plaque and calculus
   b. Trauma
   c. Ill-fitting appliances
   d. Oral habits
13. Identify the INCORRECT statement. Treatment of peripheral ossifying fibromata includes:
   a. Scaling
   b. Removal/correction of irritational factors
   c. Surgical excision
   d. Chlorhexidene mouthwash alone
Oral Medicine Case Book: Marijuana-induced Oral Leukoplakia (p 224)

14. Identify the INCORRECT statement:
   a. Has been legalized in many states in USA
   b. USA adults use twice as much marijuana as they did twenty years ago
   c. Smoking marijuana releases the same carcinogens as are found in cigarette smoke
   d. Marijuana is derived from the poppy *Papaver somniferum*
   e. Marijuana is derived from the poppy *Papaver somniferum*

15. Which diagnostic test is described in this paper as irreplaceable in the diagnosis of oral carcinoma?
   a. Vital staining using toluidine blue
   b. Vital staining using toluolm chloride
   c. Scalpel and histopathological assessment
   d. Exfoliative cytology
   e. Light based detection systems

Maxillofacial and Oral Radiology case 151 (p 227)

16. Pleomorphic adenoma is a very uncommon tumour of the salivary glands.
   a. True
   b. False

17. On MRI and CT imaging a pleomorphic adenoma of the parotid gland appears as a round lesion with a distinct boundary line between it and the surrounding tissue.
   a. True
   b. False

Forensic Case Book: The “bite mark” that caused confusion. (p 228)

18. It is recommended that photographs taken for forensic purposes should include a ruler or scale.
   a. True
   b. False

Clinical Windows (p 234)

19. In the Mouhat et al study, curing time seemed to be the factor most likely to cause temperature rise in the tissues.
   a. True
   b. False

20. The study showed that Lava COS cannot be used to take digital impressions for a large-span implant-supported construction.
   a. True
   b. False

ETHICAL

Practicing beyond your expertise: Part 10. Who’s to blame, who’s to name? (p 230)

21. Identify the INCORRECT expectation:
   a. A consenting patient has the right to expect: Competence from the dentist
   b. The use of approved materials
   c. The development of a personal friendship with the dentist
   d. The practice of recognised and accepted techniques
   e. Satisfaction with the outcome

22. The dentist has an ethical obligation to accept sponsored products from manufacturers in order to test these clinically.
   a. True
   b. False

23. Information about whether dentists have any financial interest in any institution or product which they may be promoting is confidential and need not be declared.
   a. True
   b. False

24. Identify the INCORRECT statement.
   a. Acting in the best interest and well-being of the patient,
   b. Being truthful,
   c. Allowing patients to make autonomous, informed decisions regarding their own oral health.
   d. In the endeavour to assist the patient, preparedness to embark on procedures normally reserved for specialists
   e. To report unprofessional, illegal or unethical conduct.

25. It is ethically correct to raise a concern if it is believed that the actions of a colleague may result in harm to the patient.
   a. True
   b. False
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Andolex Product Manager  
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E-mail: c.niemann@inovapharma.co.za

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Tel: 0800 22 86 87  
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Fax: 021 531 1792  
E-mail: alida@ekonodent.co.za

**Alisha Poolingam**  
Tel: 011 745 6000  
E-mail: Alisha.a.poolingam@gsk.com

**Sharon Fisher**  
Tel: 011 477 0878  
E-mail: sharon.fisher@dentsply.com

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## Plenary Programme

### FRIDAY 04 AUGUST 2017

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:30</td>
<td>REGISTRATION / LUNCH BREAK</td>
</tr>
<tr>
<td>13:30</td>
<td>KC Makhubele - SADA CEO OPENING - Take action – Own the future</td>
</tr>
<tr>
<td>14:00</td>
<td>Grant Gavin: Lessons from a traffic light</td>
</tr>
<tr>
<td>14:40</td>
<td>Leonardo Trombelli: Secondary prevention of periodontitis: When to do what</td>
</tr>
<tr>
<td>15:10</td>
<td>TEA &amp; TRADESHOW</td>
</tr>
<tr>
<td>15:40</td>
<td>Londi Shangase: The association between periodontitis and systemic diseases</td>
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<tr>
<td>16:20</td>
<td>Zaki Kanaan: Immediately implant or not to immediately implant... that is the question!</td>
</tr>
<tr>
<td>17:30</td>
<td>CONGRESS WELCOME FUNCTION: SHEbeen PARTY</td>
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### SATURDAY 05 AUGUST 2017

<table>
<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>07:30</td>
<td>REGISTRATION</td>
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<tr>
<td>08:00</td>
<td>Minister of Health</td>
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<tr>
<td>08:30</td>
<td>João Borges: Minimally invasive treatment of endodontically treated teeth</td>
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<tr>
<td>09:10</td>
<td>Cynthia Schoeman: Ethical Leadership for Professionals</td>
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<tr>
<td>09:50</td>
<td>Peet van der Vyver: Root canal irrigation: When and why to use different solutions</td>
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<td>10:30</td>
<td>TEA BREAK</td>
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<tr>
<td>11:15</td>
<td>Peet van der Vyver: Benefit of activation devices for irrigation solutions</td>
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<tr>
<td>11:55</td>
<td>Desi Moodley: Causes of failure in local anaesthesia in dentistry</td>
</tr>
<tr>
<td>12:35</td>
<td>Bradley Bredekamp: Some points to consider with implant failures</td>
</tr>
<tr>
<td>13:15</td>
<td>LUNCH BREAK</td>
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<tr>
<td>14:15</td>
<td>Mark Wertheimer: Current controversial issues in orthodontics</td>
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<tr>
<td>14:45</td>
<td>João Borges: The 5 steps to the successful achievement of the restorations of posterior teeth</td>
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<td>15:25</td>
<td>TEA BREAK</td>
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<tr>
<td>15:40</td>
<td>Dinos Kountouras: Aesthetic and functional rehabilitation of the smile using minimal invasive bonded ceramic restorations</td>
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<td>CLOSURE</td>
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### SUNDAY 06 AUGUST 2017

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<tr>
<td>08:00</td>
<td>Dale Howes: Due diligence in oral rehabilitation</td>
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<tr>
<td>08:40</td>
<td>Anushka Singh Bhima: The right to bodily integrity -The truth about Sexual Harassment in the workplace</td>
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<tr>
<td>09:30</td>
<td>BREAKFAST</td>
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<tr>
<td>10:30</td>
<td>Zaki Kanaan: Whiter than white</td>
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<tr>
<td>11:10</td>
<td>Alasdair Mc Kelvie: Professional indemnity. “Commercial expediency or a lifetime of protection? It’s your choice”</td>
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<td>TEA BREAK</td>
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<tr>
<td>12:30</td>
<td>Paul van Zyl: Less is more: occlusal considerations in the interception and treatment of dental attrition and erosion</td>
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<tr>
<td>13:10</td>
<td>Stuart Graves: Implantology without Augmentation</td>
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<td>13:50</td>
<td>SADA CEO &amp; President: CLOSURE OF CONGRESS</td>
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### SATURDAY 05 AUGUST 2017

<table>
<thead>
<tr>
<th>TIME</th>
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<tr>
<td>07:30</td>
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<tr>
<td>08:30</td>
<td>Desi Moodley: Causes of failure in local anaesthesia in dentistry</td>
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<td>TEA BREAK</td>
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<tr>
<td>11:15</td>
<td>Alasdair McKelvie: Professional indemnity. “Commercial expediency or a lifetime of protection. It’s your choice”?</td>
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<tr>
<td>12:15</td>
<td>Mark Bowes: Aesthetic dentistry for hygienists</td>
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<tr>
<td>13:15</td>
<td>LUNCH BREAK</td>
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<tr>
<td>14:15</td>
<td>Anushka Singh Bhima: Simple, soulful, self-care and the importance of it for busy super women.</td>
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<tr>
<td>15:25</td>
<td>TEA BREAK</td>
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<tr>
<td>16:00</td>
<td>Mark Wertheimer: Fundamental orthodontic considerations for the hygienist</td>
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### TIME 07:30  DENTAL ASSISTANT  PRACTICE MANAGEMENT

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<td>08:00</td>
<td>Simon Reeves: Triage of dental enquiries</td>
<td>Lizelle van der Walt (Loock): Effective practice management - The practice manager as a person</td>
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<td>TEA BREAK</td>
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<tr>
<td>11:15</td>
<td>Simon Reeves: Bridging the gap</td>
<td>Lizelle van der Walt (Loock): The practice manager’s toolbox</td>
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<td>LUNCH BREAK</td>
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<tr>
<td>14:15</td>
<td>Simon Reeves: The issue of consent</td>
<td>Lizelle van der Walt (Loock): Application and measurement</td>
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<td>TEA BREAK</td>
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<tr>
<td>15:40</td>
<td>Simon Reeves: Continue</td>
<td>Lizelle van der Walt (Loock): Continue</td>
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### SUNDAY 06 AUGUST 2017

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<tbody>
<tr>
<td>08:30</td>
<td>Dinos Kountouras: Complete Smile Design (digital and analogue methods used) from a prosthodontic perspective.</td>
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<tr>
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<td>BREAKFAST</td>
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<td>Dinos Kountouras: Diagnostic and minimal invasive treatment considerations in the complete design of the smile.</td>
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<tr>
<td>08:00</td>
<td>Stuart Graves: Vomer implants: “You thought you have to graft but you didn’t”</td>
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<tr>
<td>08:40</td>
<td>Stuart Graves: Zygomatic implants: “You thought you have to graft but you didn’t”</td>
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<td>BREAKFAST</td>
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<tr>
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<td>Stuart Graves: Pterygoid implants: “You thought you have to graft but you didn’t”</td>
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<td>11:00</td>
<td>Greg Boyes-Varley: Implantology in oncology - the surgical aspect</td>
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<tr>
<td>11:30</td>
<td>Dale Howes: Implantology in oncology - the prosthodontic aspect</td>
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Fax: 086 743 1309

Branch: Western Cape
MRO: Joseph Moalusi
Email: JMoalusi@sada.co.za
Fax: 086 743 1309

Branch: DPL Only Member
MRO: Nelisa Makubalo
Email: NMakubalo@sada.co.za
Fax: 086 758 9889

Branch: Affiliate (Non Branch Member)
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SCHOOL OF ORAL HEALTH SCIENCES

Research Day

24 August 2017

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