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6. The self-perceived sources of stress among dental students at a South African Dental School and their methods of coping

11. Types of dental emergency services provided to dentally fit soldiers in Area Military Health Unit Gauteng, South Africa

16. Analysis of the need for, and scope of training in, maxillo-facial prosthodontics in the South African dental technology programme

22. How effective are resin-based sealants in preventing caries when placed under field conditions?

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A front fanged snake, the puffadder has two long, hollow and recurved needle-sharp fangs at the anterior end of the maxilla. When not in use the fangs are folded up against the roof of the mouth in a protective fleshy sheath.

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A reptilian gift… painless dentistry

The Journal front cover has in recent years featured the TEETH of AFRICA through mammals and fishes, has offered a glimpse of the relevance of medications from our indigenous plants… and now it is the turn of the Reptiles. And what an intriguing dental odyssey is spelt out in the development of the dental arrays of our slithering, crawling, swimming fellow denizens! Zahradnicky et al unraveled some of the intricacies and in 2014 published a comprehensive review in Frontiers of Physiology.

The essential and most basic reptilian teeth are conical with a single apical cusp and serve to hold prey, allowing for gulping movements as the morsel is moved to the oesophagus. The python is a typical unicuspid snake and is capable of delivering a severe bite. However, reptilian teeth are not limited to the single cusp and multi-cuspid teeth are found in some species. The dilemma is whether the development of additional cusps follows a pattern similar to that of the mammals- or whether reptiles have a separate method of tooth development? Do reptiles rely on the enamel knot as the signaling mechanism whose influence leads to in the folding of the inner enamel epithelium which in mammals results in multiple cusps? The investigators examined foetal material in several reptile species and were able to describe, at least in species having more complex teeth, two distinct structures which appeared on the crown of the developing tooth, which they identified as enamel crests and dental cusps, but not really equivalent to an enamel knot. Whilst commonly seen, the morphology of these structures is species specific, and there are probably different developmental mechanisms involved. The essential feature is that the inner epithelial membrane does undergo folding, and that leads to the development of cusps, just as in mammals. This is seen more evidently in the highly complex teeth of the Nile monitor lizard. An intriguing similarity.

The Journal will be adorned by pictures of some of the bewildering variety of reptiles found in Africa, and will explore pertinent features of their dentition.

To take a step back, the more one delves the more one realizes just how marvelously are those 32 mammalian teeth we are privileged to develop, and the enormous relevance of maintaining their health and integrity. The World attempts to recognize their importance by assigning a Day to stimulate awareness of oral health and disease and this is scheduled to be held on March 20th with the theme Live Mouth Smart. Organised by the FDI the project aims to stimulate awareness and action from Governments and populace on Oral Health measures. (More elsewhere in this issue.)

Strangely, dentistry (and medicine) is in debt to reptilian teeth, hence did the concept of the hypodermic syringe have its “Eureka”? Admittedly, the Romans had adopted the concept of hollow tubes after a Greek myth related how Pan used hollow reeds to fashion his famous pipes whilst searching for a nymph named Syrinx, hence “syringe”! But the Romans also observed how toxins were delivered through the hollow teeth of snakes. The idea stuck! Simple piston syringes were described by the first century Roman scholar Aulus Cornelius Celsus and mention was also made by the Greek surgeon Galen. Some 800 years later Ammar bin Ali Al-Mawsili, an Egyptian surgeon, used hollow glass tubes and a piston to remove cataracts from the eyes of his patients. The underlying theoretical basis for the workings of a syringe are embodied in Pascal’s law, "when there is an increase in pressure at any point in a confined fluid, there is an equal increase at every other point in the container." And Pascal himself invented the first modern syringe. Would you believe that an architect, Sir Christopher Wren of London fame, undertook the first intravenous experiment when he used hollow goose feather quills linked to a syringe to inject opium into stray dogs? (No mention of the outcome! Confused canines?)

A steel needle, hollow and sharp, was developed by an Irishman, Francis Rynd, in 1844. The scene is increasingly international, with both French and Scottish input refining the needle design. Not mentioned thus far are two German doctors who also experimented, with injections into humans, that was back in the 1660’s. That this has been achieved is the frightening and threatening. That this has been achieved is the constant awareness of the need to ensure that it is less frightening and threatening. That this has been achieved is the
message which should be emphasized again and again on March 20th. Patients should know that it is quite possible to Live Mouth Smart and to maintain high levels of Oral Health.

But should we admit that at least some of the reduction in pain is due ultimately to a snake?

References

OBITUARY

Professor Mario Altini
19 September 1949 – 10 February 2017

It is with profound sadness that I bid farewell to my mentor, colleague and very dear friend, Professor Mario Altini. It is not easy to say goodbye to the inspiring, well respected, and righteous gentleman and exceptionally devoted Oral Pathologist that I had come to know over the last 22 years.

Mario Altini graduated as a dentist (BDS, 1973) and specialist Oral Pathologist (MDent, 1977) at WITS. Under the tutelage of the late Professor Mervyn Shear, he rose to become Acting Head and Honorary Professor of the Department of Oral Pathology in 1984, and full time Head in 1990. He held the post through to his official retirement due to ill health in 2011. He was world renowned and was recognised internationally by the International Association of Oral Pathology with the distinction of an Honorary Life Membership. He was awarded an FC Path (SA) in 2004. Professor Altini was a Councillor of the International Association of Oral Pathologists, President of the South African Society of Oral Pathology and Microbiology, Executive member of the South Africa Society of Forensic Dentistry and Honorary Consultant in Forensic Dentistry with the Department of Health.

Mario Altini had an exceptional career as a dentist, which began in Braamfontein in 1973 and continued in Glendower until 2012. He was an outstanding, gentle and popular dentist whilst remaining uniquely passionate to his chosen field of Oral Pathology. Mario was an excellent teacher, with a willingness to share all that he knew. He taught his students with compassion and enthusiasm, captivating his audience of budding dentists and future specialists in all dental fields, and inspiring many to follow him into the discipline.

In 2002, Mario was diagnosed with Parkinson’s disease, which although overwhelming at times, he bore unflinchingly and with dignity. This affliction did not diminish his colossal spirit. His incredible and significant scientific contribution to Oral Pathology was recognised by WITS awarding him the most illustrious degree, DSc (Medicine) entitled “From Odontomes to AIDS” in 2013 for his lifetime’s research journey. Professor Mario Altini’s remarkable academic body of work lists more than 115 scientific publications, chapters in books, and extensive postgraduate supervision and examination. His influence on the field was immense with specialists trained in his Department moving on to hold senior positions in this and other institutions of higher learning, nationally and internationally.

Over his many years in Oral Pathology, Mario always held a special relationship with the Department of Anatomical Pathology, which continued to develop with Oral Pathology registrars spending dedicated time in Anatomical Pathology as part of their post-graduate training requirements.

Following his early retirement from the Department of Oral Pathology, he returned to the academic environment in May 2013 as the Research co-ordinator and Honorary Professor and then Visiting Professor in the Department of Anatomical Pathology, readily imparting his wealth of knowledge and depth of experience that he had acquired over the years.

We can reminisce about a man with exceptional intellect and influence, yet humble, principled, kind and generous. His caring showed no bounds, that even in his last days in hospital, he showed more concern about my health and wellbeing than his own.

Mario’s passion extended beyond pathology. He enjoyed spending time with his family and friends, family vacations, playing golf, theatre, art films and watching sport. He took great pride in his family; his wife, Gail, daughter Jennifer, sons Gareth, Nicholas and David, daughters in law, Shirleen, Dana and Megan and his six grandchildren. We extend our heartfelt condolences to you. We take comfort that although too brief, we celebrate a worthy life. His legacy lives on in so many indefinable ways.

We will always remember Prof Altini as a knowledgeable professional with an enviable reputation, a great teacher, colleague and friend.

Thank you, Prof. You will be sorely missed.

Shabnum Meer (Oral Pathology, WITS)
Professor Mervyn Shear
24 November 1931 – 24 January 2017

I write this tribute to Professor Mervyn Shear with sincere gratitude; mourning the loss of a giant in the world of Oral Pathology. It is indeed sad news for every member of our specialty. His legacy however will remain forever.

Emeritus Professor Mervyn Shear (UWC [2007]; WITS [1992]), internationally renowned and a global household name in Oral and Maxillofacial Pathology and Surgery died in Simonstown on Tuesday, 24 January 2017. Professor Shear was born in Johannesburg and graduated with a BDS in 1954 from WITS and the Royal College of South Africa, with the MDS (Oral Pathology) in 1961 from WITS and FRC Path from the Royal College of Pathologists in 1965. He completed the most eminent degree at WITS, the DSc (Dentistry) in 1973.

As the pioneer of Oral Pathology both in South Africa and worldwide, Professor Shear received the esteemed recognition of Honorary Life Membership from the International Association of Oral and Maxillofacial Pathologists (past president), the British Society of Oral and Maxillofacial Pathologists, Scandinavian Society of Oral and Maxillofacial Pathologists and SADA.

Until about 1953, Oral Pathology as we know it today was not practised in South Africa. When Mervyn Shear was a final year dental student at Wits in 1954, the course was given by Professor Julius Staz. Professor Shear enjoyed the course thoroughly and regarded them as the best lectures he had at the dental school. Following a short stint at Eastman Dental Institute, Mervyn immediately set about organising a biopsy service and focusing on establishing the speciality of Oral Pathology. He was the first chair of the discipline in South Africa and contributed greatly, despite some resistance, to Oral Pathology being affiliated to Anatomical Pathology.

Mervyn's immense contribution to the field and beyond was recognised with the distinguished award of honorary degrees: Doctor of Laws, LLD (WITS, 1992), DChD (UP, 1999), FCD (CMSA, 1999) and FCPath (CMSA, 2004). He began lecturing at WITS in 1955 and was Head of Department from 1968 to 1986. He enjoyed being Visiting Professor at the University of Illinois, Royal Dental College, Copenhagen and the University of Adelaide. Before being appointed Extraordinary Professor at UWC in 1993, Professor Shear was the Deputy Vice Chancellor at WITS (1983-1990), Chair of the Eastern Seaboard Association Tertiary Institutions, KwaZulu-Natal, and member of the Council of the Universities of Durban-Westville and Lesotho.

Mervyn was a great pathologist, educator, writer, colleague and friend to many. He was kind, always having students' interests at heart. He was fondly known as “the cyst man” and will always be remembered as the foremost authority on cysts of the oral region, via his pioneering, seminal and indispensable text “Cysts of the Oral and Maxillofacial Regions”, the fourth edition of which was published in 2007. He also co-authored the first two WHO editions of “Histological Typing of Odontogenic Tumours”, and had more than 115 scientific publications.

I first met Professor Shear in Cape Town in 1993, when he took me under his wing as a young dentist. We jointly presented a paper on “The histogenesis of the Complex Odontome” at the IADR. I had the privilege of getting to know him and to enjoy his exceptional knowledge, passion, unbounded enthusiasm, insight and support. He remained a great colleague, mentor and friend. It was Prof Shear who prompted the uprooting of my family to Johannesburg to enable my training as an Oral Pathologist with none other than Professor Mario Altini at WITS.

As many may know, Prof Shear and his late wife Dr Caryll Frances Posel were proud members of the ANC. He was a great liberal, a brave political activist and forward thinker, and is often remembered as being a little mischievous. There are many stories about his being a thorn in the side of the apartheid government. He would often gather his staff to protest on the WITS lawns during those turbulent anti-apartheid demonstrations, with much resistance from many. It has been said that during one period of unrest, whilst police helicopters were buzzing over the campus, Mervyn had the students place chairs on the lawn in an arrangement which from an aerial view formed the outline of a not-so-kosher profanity.

Mervyn enjoyed life as he did his profession, spending his days listening to classical music, reading, swimming and walking. He loved entertaining friends and colleagues, and even Nelson Mandela at his home in Simonstown, impressing his guests with exquisite cuisine and a phenomenal collection of African and International art and art history.

One surely cannot be an oral pathologist without knowing Mervyn Shear, a remarkable oral pathologist and man. Professor Shear you will be dearly missed. I am sure that many of you will join me in bidding a fond farewell to such a great colleague. His essence will surely live on through his great contribution to Oral Pathology, in particular, and the kind and thoughtful person that he was.

Our condolences go to his son, Dr Keith Shear in Birmingham.

Thank you, Professor Shear. Hamba Kahle.

Shabnum Meer (Oral Pathology, WITS)
The World looks at Oral Health

World Oral Health Day (WOHD) is celebrated each year on 20 March. It is the culmination of a year-long campaign dedicated to raising global awareness on the prevention and control of oral disease. WOHD spreads messages about good oral hygiene practices to adults and children alike and demonstrates the importance of optimal oral health in maintaining general health and well-being. It also aims to raise the profile of oral health on the global health and development agenda by highlighting the social and economic impacts of oral disease.

WOHD is the largest global awareness campaign on oral health. Each year, it focuses on a specific theme and reaches out to the general public, oral health professionals and policymakers, who all have a role to play in helping reduce the burden of oral disease. WOHD inspires them to take action.

In a world where 90% of the population will suffer from oral disease during their lifetime, WOHD is a key date in the oral health community agenda. It’s an occasion when people around the globe unite to put the spotlight on the immense burden caused by oral disease and is an opportunity to remind our target audiences that investment in prevention yields dividends in oral health and general health. It is also a day to salute the hard work of dental practitioners and the dental industry to improve the state of oral health in the world.

The 2017 campaign theme: ‘Live Mouth Smart’ empowers people to take control of their oral health – throughout life – so they can enjoy a healthy, functional mouth from childhood into old age.

It conveys the message that by making smart decisions such as adopting good oral hygiene habits, avoiding risk factors and having a regular dental check-up, oral disease can be prevented. The imagery is positive and focuses on oral health as much more than a nice smile. It highlights how basic oral functions that are core to life – ability to speak, smile, sigh and kiss, smell, taste, touch, chew, swallow and convey a world of emotions through facial expressions – are affected and how this relates to physiological, social and psychological well-being. The campaign strives to make people understand the broad consequences of oral disease and how poor oral health affects general health and well-being. It stresses the impact of oral disease on various aspects of a person’s social life, which can lead to low self-esteem, diminished social interactions, poor school performance, lack of confidence, and meagre employment prospects. All stakeholders – general public, oral health professionals and policymakers – must work together to address the disease burden and take the necessary action so that populations can Live Mouth Smart.

ORAL HEALTH PROFESSIONALS:
Help your patients Live Mouth Smart by:

Educating them on how to prevent and control oral disease, enabling them to avoid any unnecessary pain or suffering and enjoy a better quality of life into old age. You also champion prevention and early detection to help ensure the best patient outcomes though the reduction of oral disease and any associated health complications.

Teaching good oral hygiene habits, particularly the importance of brushing twice a day for two minutes with fluoride toothpaste and having regular dental check-ups.

Providing information and guidance on how to control risk factors including tobacco use, harmful use of alcohol and unhealthy diets – especially those rich in sugar – to help protect the oral health of your patients and prevent other conditions such as heart disease and stroke, cancer, chronic respiratory diseases and diabetes.

Avoiding surgical intervention through prompt and efficacious application of preventive care to a specific lesion, once it has been detected and assessed. This provides a very significant opportunity to preserve dental tissue and to stop lesions from ever progressing to the stage at which surgical intervention is required. This aspect of caries care is a priority and should be fully integrated into routine dental practice for all age groups.

Organising World Oral Health Day activities on 20 March in your practice or work to show your patients/public that you are committed to helping them prevent and control oral disease and are contributing to their overall health and well-being. There are resources, ideas and suggestions for a successful Oral Health Day on the FDI website.

Nurturing the profession. Ensuring continuity and vitality of the profession by contributing to Dental Education. One of the most significant opportunities to advance Oral Health globally is to ensure excellence in education for the next generation of dentists. Enthusiasm, participation, commitment amongst our student bodies will be generated by the example of sincere involvement by the profession at large.

Source acknowledgement: www.fdi.com
The self-perceived sources of stress among dental students at a South African Dental School and their methods of coping

ABSTRACT

Introduction: Dental students have reported that, as a result of the nature of the dental curriculum, they are under severe stress while studying.

Aim: to determine how students perceived the sources of stress and to identify the coping mechanisms used.

Methods: This was a cross-sectional analytical study using a standardized self-administered questionnaire. All dental students registered in 2015 were invited to participate. All data was secured as confidential and anonymous.

Results: Responses were received from 224 students (74%, of whom 26% were male). One third of responding males and 45% of responding females reported severe levels of stress. Clinical students reported a significantly higher (p=0.002) prevalence of severe stress over non-clinical students. The most common causes of severe stress were fear of failure (47%) and high workload (38%). The coping mechanisms included sleeping (64%) and watching television (55%). More than a quarter contemplated changing from Dentistry as a result of their perceived stress. Those who reported having severe stress were 1.8 and 2.1 times more likely to quit Dentistry or to commit suicide.

Conclusion: Females and clinical students reported higher levels of severe stress. Those with severe stress were significantly more likely to contemplate quitting Dentistry or suicide.

INTRODUCTION

Tertiary education leading to any qualification is often associated with high levels of stress. Stress can be defined as pressure, external demands and anxiety acting on an individual's mental and physical state and caused by a problematic external environment. The perception of stress depends on an individual's beliefs, knowledge, attitude and behaviour. Dental students reported considerably more stress symptoms while studying, were more anxious and showed higher levels of depression, obsessive-compulsive disorders and interpersonal sensitivity than age-matched controls. This could be due to a multitude of factors including self-efficacy beliefs, assigned workload and performance pressure. Additionally and importantly, dental students are faced with stress related to clinical sessions and patient management. These include late or failed patient appointments, clinical quotas, dealing with uncooperative patients, highly skilled technical work, academic capability and financial factors. These stressors can lead to absenteeism, poor academic results, unsatisfactory work ethic, substance abuse and depression.

Previous studies related to stress among dental students focused mainly on clinical students without regard for pre-clinical classes. Some studies concentrated on only one gender or compared the results with studies on medical students while others focused solely on negative and harmful coping mechanisms. Most studies took into consideration the effects of coping on the health and/or grades of students but very few have determined the types of mechanisms best suited for dental students. Limited studies have been carried out and published in South Africa in the past, most of which have been done in the Western Cape and while the majority were on dental students, one involved oral hygiene students. However, none of these studies have examined the coping mechanisms employed by the students to help deal with the stressors.

The aim of the current study was to determine the self-perceived stress levels, sources and coping mechanisms...
at a dental school in Gauteng, South Africa. The results provide baseline information on local stressors among dental students and may assist in the implementation and evaluation of stress management programs, if these are required. The study is unique as it compares data between the different years of study and the gender on the stressors affecting the students and the coping mechanisms on which they relied.

**METHODS**

This was a cross sectional analytical study and all dental students registered at a Gauteng dental school during the 2015 academic year were invited to participate (n=301). A standardised validated questionnaire was used to elicit the prerequisite information. The questionnaire had been used in previous studies and as a result was not piloted nor modified in any way. It was hand delivered to each class and all students were invited to complete it anonymously. It consisted of four sections with 29 closed and three open-ended questions. The first section elicited information about local stressors and the coping mechanisms on which they relied.

Each student was asked to rate, based on their personal experience, a list of possible stressors as being responsible for either "low", "moderate" or "severe" stress in their daily lives. The items that received the highest number of "severe" stress responses were identified as the most common stressors among each class or cohort. The results were considered in two categories: pre-clinical (first and second year students) and clinical (third, fourth and fifth year students). This categorization was based on the fact that as students move into a clinical environment, they are required to treat patients, including the administration of anaesthetics, undertaking extractions, completing restorations etc. This transition and enhanced responsibility has been shown to be extremely stressful and as a result, many studies have separated the students into pre-clinical and clinical categories.

All data were treated as strictly confidential and were entered and analyzed using the SPSS software package. Frequency distributions were utilized to identify the common stressors and the common coping mechanisms while the chi-square test was used to determine any association between the stressors and the gender and year of study. A logistic regression was done to identify behaviour patterns that were strongly associated with high levels of stress and for this analysis, "low" and "moderate" stress were combined to form one category while "severe" stress formed a second category.

**RESULTS**

Of the 301 students registered in 2015, 224 (74%) completed the questionnaire satisfactorily. The majority of students were female (74%) and most of the respondents felt that they had either moderate (45%) or severe stress (42%). The association between the self-perceived levels of stress and gender and clinical status is shown in Table 1. There were no significant differences in the levels of self-reported stress between male and female students (p=0.158). Almost half of the males (48%) reported having moderate stress and almost the same percentage of females reported either moderate (45%) or severe (45%) levels of stress. The clinical students reported a significantly higher prevalence of severe stress compared with pre-clinical students. The most common stressors, the coping mechanisms and the strategies that could be used to reduce stress are listed in descending order in Table 2. (Many students

| Table 1: Distribution of self-reported stress in relation to gender and clinical status (n=224) |
|---------------------------------|------------------|------------------|------------------|------------------|
|                                | TOTAL            | Low stress       | Moderate stress  | Severe stress    |
| Total sample                   | 224 (100)        | 29 (13)          | 102 (45)         | 93 (42)          |
| GENDER                        |                  |                  |                  |                  |
| Male                          | 57 (26)          | 11 (19)          | 28 (48)          | 19 (33)          |
| Female                        | 166 (74)         | 18 (10)          | 74 (45)          | 74 (45)          |
| p-Value*                      |                  |                  |                  | 0.158            |
| PRE-CLINICAL VS CLINICAL      |                  |                  |                  |                  |
| Pre-clinical                  | 114 (51)         | 13 (11)          | 66 (58)          | 35 (31)          |
| Clinical                      | 110 (49)         | 16 (14)          | 36 (33)          | 58 (53)          |
| p-Value*                      |                  |                  |                  | 0.001            |

*p-Value calculated using chi-square test

<table>
<thead>
<tr>
<th>Table 2: The most common stressors, coping mechanisms and strategies to cope with stress, according to gender (n=224)</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td><strong>Stressors</strong></td>
</tr>
<tr>
<td>1. Fear of failing examinations/tests                                                                     105 (47)</td>
</tr>
<tr>
<td>2. Unable to keep up with workload                                                                       77 (34)</td>
</tr>
<tr>
<td>3. Too much work outside lecture times                                                                      51 (23)</td>
</tr>
<tr>
<td>4. Criticism on work performed                                                                          49 (22)</td>
</tr>
<tr>
<td>5. Financial responsibilities                                                                          45 (20)</td>
</tr>
<tr>
<td><strong>Coping mechanisms</strong></td>
</tr>
<tr>
<td>1. Sleep</td>
</tr>
<tr>
<td>2. Watch television</td>
</tr>
<tr>
<td>3. Socializing</td>
</tr>
<tr>
<td>4. Physical exercise</td>
</tr>
<tr>
<td>5. Becoming emotional</td>
</tr>
<tr>
<td>6. Use of recreational drugs</td>
</tr>
<tr>
<td><strong>Strategies to help deal with stress</strong></td>
</tr>
<tr>
<td>1. Reduce workload</td>
</tr>
<tr>
<td>2. Coping mechanisms in curriculum</td>
</tr>
<tr>
<td>3. Increase social activities</td>
</tr>
</tbody>
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RESEARCH
selected more than one stressor and as a result, the combined percentages are greater than one hundred.) Overall, most of the students felt the fear of failure (47%) and an inability to keep up with the workload (37%) were the overriding stressors.

The most commonly used coping mechanism, irrespective of gender, was sleeping (64%), while 13% of students reported using recreational drugs to help cope. There were no significant differences in the coping mechanisms employed between males and females, however, more females (25%) felt that they became emotional when stressed compared with males (12%). More males (21%) compared with females (10%) disclosed that they were likely to use recreational drugs to help cope. Almost half of the students (46%) felt that the levels of stress could be reduced by decreasing the workload while 38% requested that lectures on how to deal with stress be included in the teaching curriculum.

The most common stressors, coping mechanisms and strategies that were used to reduce stress in relation to the clinical status are shown in Table 3.

Table 4 shows the breakdown of students who contemplated changing their course of study, quitting Dentistry or committing suicide as a result of stress. A significantly larger proportion of clinical students had considered quitting Dentistry compared with pre-clinical students (p=0.001). In general, males and clinical students were more likely to change their course, quit Dentistry or commit suicide.

The logistic regression identified three behaviour patterns as significantly associated with high stress levels (Table 5).

Those with severe stress were almost twice as likely to consider quitting Dentistry (adjusted OR 1.84; CI 0.39-0.00) and more than twice as likely to contemplate committing suicide (adjusted OR 2.21; CI 0.90-0.13) compared with their counterparts. These results need to be interpreted with caution as the study utilised a cross sectional design.

DISCUSSION

The response rate was 74%, a result similar to previous studies. Missing were students who were absent or who did not complete the questionnaires satisfactorily. Almost three quarters were female, representative of the gender profile of the registered students.

The majority of the respondents reported having either moderate (45%) or severe stress (42%) which was in accordance with other published studies. The clinical...
students reported significantly higher levels of severe stress compared with the pre-clinical students and this was in accord with other studies. The high levels of severe stress among clinical students has been attributed to stress that is caused by clinical procedures, clinical quotas, failed appointments and other patient-related issues. Almost half of the females (45%) in the current study reported having ‘severe’ stress compared with 33% of the males (Table 1) and a quarter of all females (25%) reported becoming emotional as a result of stress. This could be related to different psychological characteristics, with females tending to express their concerns more freely than do males who are constrained by their perceived masculinity and ego status.

Irrespective of the gender or the clinical status, the most common perceived stressor was the fear of failure and examinations (Tables 2 and 3) which was consistent with the findings of other studies. More than half (52%) of the pre-clinical students were afraid of failing their examinations (Table 3) possibly as a result of the transition from a school to a tertiary environment (and perhaps their inability to manage their time adequately). Considerably more clinical compared with pre-clinical students (31% versus 15%) felt that there was too much work outside lecture times which resulted in severe stress (Table 3). This could be related to the demands of clinical quotas and the tensions of treating patients which often takes up considerable periods of time, as reported by previous studies.

Stressors such as receiving criticism and the pressures of financial responsibilities were common for all students irrespective of gender and clinical status and have been shown to apply to students from other fields of study as well. Indeed a study carried out in 1982 had identified “sensitivity to criticism” as the top stressor. Little appears to have changed.

Almost two thirds (64%) of respondents claimed that sleeping helped them cope with stress. As suggested in other papers, this could be due to their exhaustion as a result of the perceived increased workload and patient demands.

Other common coping mechanisms included watching television or movies, socializing with friends and physical exercise; these release options were similar to those described in previous studies.

It is evident that programs need to be implemented to address the high stress levels experienced by the students. Many students (46%) perceived an overwhelmingly high workload. This combined with a request to include guidance on coping mechanisms in the undergraduate training should be of concern to dental academics and should be openly discussed in pursuit of solutions. Social activities have been shown to reduce stress and a quarter of students felt that such events would help them cope with their stress. This might be a viable option requiring minimal costs and infrastructure compared with other possible interventions.

Of concern was the fact that 21% of males and 16% of clinical students reported the use of recreational drugs to help them cope with stress (Tables 2 and 3). Admittedly, a previous study carried out in 2002 in the United Kingdom, had reported a much higher prevalence of illicit drugs and alcohol abuse. Since then, knowledge and attitudes regarding drugs, alcohol and smoking have escalated. It is also possible, of course, that the current cohort did not answer honestly due to fear and the possible legal and social repercussions that may arise due to their disclosure. Almost a third of all clinical students (Table 3) either wanted to change their course (31%) or to quit Dentistry (31%). This could be as a result of the burgeoning workload, high patient expectations and the number of clinical requirements demanded of them.

There were six students who had contemplated committing suicide as a result of stress associated with studying Dentistry. This serious discovery must be noted and appropriate stress management programs implemented.

The students who reported having severe stress were 1.8 and 2.1 times more likely to quit Dentistry or to commit suicide as compared with those suffering moderate and low stress respectively. This confirms existing literature which highlights that dentists in general are unable to cope with stress and lack adequate stress-coping mechanisms. As a result many authors have suggested that the dental curriculum should include lectures on stress management, time management, communication skills and behaviour management. The respondents in the current study do in fact receive lectures on communication and time and practice management. However, these lectures are towards the end of the dental curriculum and perhaps should be moved to earlier on in the curriculum. This could help students cope with the current stress levels and also equip them to deal with stress in their future professional careers.

LIMITATIONS

These results were obtained from a single School of Dentistry in Gauteng and as a result are not necessarily representative of all dental students in South Africa.

CONCLUSION

Stress amongst dental students has been shown to be of considerable concern, with severe levels causing a few students to even contemplate suicide. Effective means of reducing stress should be explored together with determining effective methods of coping with the tensions.

RECOMMENDATIONS

Urgent intervention is needed to address the high levels of stress in order to prevent students from using recreational drugs and other unhealthy alternatives. It is recommended that stress management lectures are included early in the curriculum so that students are given the tools to help them cope with the increased demands of studying Dentistry. In addition, social activities such as sports days, regular social evenings, team building exercises etc. could be introduced which could help staff and students to interact and possibly create a more socially acceptable and stress-free friendly environment. The dental curriculum should be examined to identify areas which could be major causes of stress and methods devised to alleviate the problem as much as possible.
Acknowledgements

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References

Types of dental emergency services provided to dentally fit soldiers in Area Military Health Unit Gauteng, South Africa

ABSTRACT

Background: The prevention and treatment of dental diseases are important in maintaining a combat-ready military force.

Aim: To determine the type of dental emergency treatments provided over 12 months to soldiers who had been classified as dentally fit.

Methods: A retrospective analysis was carried out of the dental records of members of the South African National Defence Force in Gauteng who had been screened and certified to be dentally fit in 2009. The records of the participants were followed up for a year thereafter to determine the profile of dental emergency treatments rendered. Data analysis included frequencies and correlations using chi-square tests. The level of significance was set at p<0.05.

Results: Of the 6352 soldiers deemed to be dentally fit, 1947 (30.7%) returned for treatment within 12 months. Most required dental restorations (59%) followed by extractions (13%) and crown/bridge repairs (12%). In general, males, soldiers between 41 and 50 years, non-commissioned officers, Whites and Oral Health Fitness II (OHF) received more dental emergency services compared with their counterparts.

Conclusions: A large number of soldiers previously determined as dentally fit required restorations and extractions within a year. The treatment procedure profile was influenced by OHF classification, race, age and military rank.

Keywords: Dental procedures, Dental Fitness Classification, Military

INTRODUCTION

Dental emergencies within the military environment are a potential threat to any military mission as the result could be the removal of soldiers from their assigned places of duty. The prevention and treatment of dental diseases are therefore essential in maintaining a combat-ready military force as dental emergencies have a direct effect on a person's health and could reduce combat effectiveness and the capability of a deployed force to accomplish its assigned mission, a major concern for military planners. A study of a deployed armoured division reported that dental complaints ranked second only to upper respiratory tract infections as a cause of lost duty time. This meant that the prevalence of dental conditions was extremely high and debilitating for the soldiers. Dental complications may therefore have dire consequences as the poor dental health of one individual can compromise the effectiveness of the entire unit.

Dental readiness is an integral component of the overall medical readiness program of the South African National Defence Forces (SANDF), which defines full readiness as being healthy in all categories, including oral health. The SANDF uses the Oral Health Fitness (OHF) classification to categorise the dental readiness status of all military personnel, a system similar to that used by members of the North Atlantic Treaty Organization (NATO), which is defined in the Standard Agreement (STANAG) 2466. This classification consists of four OHF categories:

1. Class I: fully dentally fit and requires no dental treatment;
2. Class II: minor dental treatment is required but the condition/s are not expected to cause a problem within the next year;
3. Class III: treatment is required and the condition/s is/are expected to cause a problem within the next year;
4. Class IV: dental examination has expired after 12 months or the member has never been classified.

ACRONYMS

OHF: Oral Health Fitness
SANDF: South African National Defence Force
Personnel who are classified as OHF class I and II meet the criteria for dental readiness and are therefore considered deployable and ready for any operational assignment. This status is valid for a single year and soldiers must be screened annually to ensure that their medical status is updated. The aim of the dental readiness program is to ensure that all personnel are either in Class I or II and those who do not fall into these categories need to be treated to achieve Class I or II status. According to the OHF classification system, the SANDF strives to achieve oral health fitness by focusing treatment towards those conditions, which, if left untreated, could result in a dental emergency within 12 months. A dental emergency is defined as any condition that has the potential to cause pain, uncontrolled haemorrhage, acute infection or loss of masticatory function, which may significantly impact on the patient’s performance of duties.

It is essential to determine the types of emergency treatment required by OHF I and II soldiers as it helps in the planning and managing of soldiers required for deployment. It also gives a breakdown of the type of services most commonly required and this will assist in the employment of suitably qualified personnel and the calculation of resources that may be required. This study focused on the type of dental emergency treatment rendered to members in OHF classes I and II as they were regarded as dentally fit and deployable. No similar study has produced baseline data for the planning and monitoring of dental services for soldiers.

The aim of the study was therefore to determine the type of dental emergency treatment provided over a one year period to soldiers who had previously been classified as dentally fit using the OHF classification criteria.

**Methods**

This was a cross-sectional retrospective record-based study, which included all the records of members of the SANDF who had received an OHF classification of I and II in Area Military Health Unit, Gauteng, during 2009. The records of the 12 months following the initial screenings were examined to identify whether the soldiers had received any dental emergency treatment during this time. Those procedures were recorded using a standardized data capturing tool and included the number of extractions, restorations, endodontic treatments, crown and bridge related problems, denture problems, tooth sensitivity and medication. The “restorations” category included amalgam, composite and temporary restorations. The “extractions” included the removal of teeth, root rests, impacted teeth and surgical extractions. The “crown and bridge” related problems included re-cementing of an existing prosthesis and delivering of a new prosthesis. Since there were very few soldiers who presented with denture problems, sensitivity of teeth or required medication for dental problems, these services were combined to form a miscellaneous group which was classified as “other services”.

In addition to the type of services being rendered, demographic information such as gender, race (self identified), OHF and military rank was also recorded. As far as rank was concerned, the soldiers were divided into the following three groups: Generals and senior officers, Junior and Warrant officers and Non-Commissioned officers (includes Privates, Lance Corporals, Corporals, Sergeants and Staff Sergeants).

A total of 6352 soldiers had received an OHF classification of I or II in Gauteng during 2009 and all of their records were captured and analyzed. All data was confidential and anonymity was ensured by not including any names. Ethical clearance was obtained from the University of Pretoria Ethical committee (Ref 98/2011). Data analysis was carried out with the use of SPSS version 23. Group differences were assessed using chi-square statistics and odds ratios. Data analysis included frequencies of dental emergency procedures and chi-square tests. The level of significance was set at \( p < 0.05 \).

**Results**

The sample of 6352 soldiers had a mean age of 40 years, and 46.4% had received an OHF classification of I, whilst 53.6% were categorized as OH II. The majority of participants were Blacks (72%) followed by Whites (21%) with Coloureds and Asians at 6% and 1% respectively. As far as gender was concerned the majority were males at 70%. Almost a third of the sample, (31% \( n = 1947 \)) developed a dental emergency within the twelve month period of the study and had to receive treatment. The dental emergency rate was therefore 1947 of 6352 which was translated to 307/1000 per annum.

A total of 3374 dental emergency procedures were performed on the 1947 soldiers with an average of 1.7 emergency procedures per individual. Most common were restorations (59%), extractions (13%), crown and bridge related treatments (12%) and endodontic treatment (4%) (Figure 1). The association between dental emergency procedures and gender, age, race, rank and OHF classification are shown in Table 1. The number of dental emergency procedures associated with each variable was expressed as a percentage of the total procedures delivered. In general, males, soldiers between 41 and 50 years, non-commissioned officers, Whites and OHF II received more dental emergency services compared with their counterparts. Soldiers between 40 and 51 years old, Blacks, non-commissioned officers and those classified as OHF II received significantly more extractions compared with the other groups.

In terms of restorations, soldiers between 41and 50 years old and non-commissioned officers received significantly more services compared with the rest of the sample.

With respect to endodontics and crown and bridge work, the generals and senior officers, soldiers and Whites were the majority recipients of these services.

![Figure 1: Breakdown (%) of the dental emergency procedures performed (n=3374)](image-url)
Of the total of 6352 soldiers who had received an OHF classification of I or II, 70% were male. This was consistent with other international studies which reported more males being recruited into the military services than females.7,8 The demographics of South Africa, with a population having 80% Blacks, were reflected in the sample of the soldiers who had been screened, which included 72% Black candidates.9

The mean age of the soldiers was 40 years, possibly showing that the military has a distribution of both young and older soldiers. The older, more senior soldiers were more often in management positions, while the younger soldiers were more likely to be involved in deployment exercises.

It was unexpected to find that almost a third (31%) of those soldiers who had been classified as OHF I and II, who should have been dentally fit and ready to be deployed, experienced a dental emergency within 12 months. According to the literature, the dental emergency rate of 307/1000 per year (31%) is regarded as high as this implies that for every ten soldiers certified dentally fit, three will nevertheless experience a dental emergency.10 This could be due to many factors including the possibilities that the screening tool was not sensitive enough to detect impending dental emergencies or that the staff members were not adequately trained and calibrated to carry out the screening effectively. It could also imply that many soldiers are exposed to traumatic conditions which could result in oral trauma such as teeth being broken, prostheses being knocked out or restorations fractured.

These data expose a problem of some relevance. A possible solution could be to select one or two dentists from each facility, tasking them exclusively with the screening procedure. These staff members should be trained and made aware of the guidelines related to the OHF classification system. They also need to be calibrated in order that a uniform classification system may be applied across the country. This would reduce possible variations with the screening and assist in the detection and diagnosis of dental conditions which have the potential to become emergencies within a one year period. Another possible solution is to reduce the duration of validity of the classification from one year to six months. The year-long period between screenings may be too long and as a result many potential emergency dental conditions were missed. However, this has severe implications as it would consume a large amount of time and resources which would probably make the sequence unsustainable.

Another concern is the fact that those who did present with dental emergencies required, statistically, almost two treatments (1.7) per year. This further emphasizes the need for calibration among the dentists who are performing the screening as it appears they are not consistently successful in diagnosing those who are at high risk of developing dental emergencies.

If the current situation persists, it could have dire consequences as it implies that three out of every ten soldiers who were classified as dentally fit actually developed a dental emergency. This would impact on deployment and conceivably on the ultimate success or failure of South African military missions.

Dental restorations were the most commonly required service (59%), followed by extractions (13%) and crown

Table 1: Association between most common emergency dental procedures and gender, age, rank, race and OHF classification

<table>
<thead>
<tr>
<th>Total procedures</th>
<th>Extraction n=423</th>
<th>Restoration n=2003</th>
<th>Endo n=146</th>
<th>Crown n=401</th>
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</thead>
<tbody>
<tr>
<td>p-Value</td>
<td>p-Value</td>
<td>p-Value</td>
<td>p-Value</td>
<td>p-Value</td>
</tr>
<tr>
<td>------------------</td>
<td>------------------</td>
<td>-------------------</td>
<td>------------</td>
<td>------------</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>2166 (64)</td>
<td>281(66)</td>
<td>1286(64.2)</td>
<td>88(59)</td>
</tr>
<tr>
<td></td>
<td>1208 (36)</td>
<td>142(34)</td>
<td>717(35.8)</td>
<td>60(41)</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-40</td>
<td>761 (23)</td>
<td>85 (20)</td>
<td>540 (27)</td>
<td>32 (22)</td>
</tr>
<tr>
<td>41-50</td>
<td>1332 (40)</td>
<td>195(46)</td>
<td>807(40)</td>
<td>65 (45)</td>
</tr>
<tr>
<td>&gt;51</td>
<td>1281 (38)</td>
<td>143(34)</td>
<td>656(33)</td>
<td>49(34)</td>
</tr>
<tr>
<td>Rank</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General and</td>
<td>1120 (33)</td>
<td>86 (20)</td>
<td>656 (33)</td>
<td>53 (36)</td>
</tr>
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<td>Senior officers</td>
<td></td>
<td>132(31)</td>
<td>539 (27)</td>
<td>45 (31)</td>
</tr>
<tr>
<td>Junior and</td>
<td>979 (29)</td>
<td>205(49)</td>
<td>808 (40)</td>
<td>48(33)</td>
</tr>
<tr>
<td>Warrant officers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non commissioned</td>
<td>1275 (38)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>officers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>73 (2)</td>
<td>5(1)</td>
<td>49(2)</td>
<td>2(1.4)</td>
</tr>
<tr>
<td>Black</td>
<td>1053 (41)</td>
<td>244(58)</td>
<td>829(41)</td>
<td>44(30)</td>
</tr>
<tr>
<td>Coloured</td>
<td>255 (8)</td>
<td>29(7)</td>
<td>149(7)</td>
<td>21(14)</td>
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<tr>
<td>White</td>
<td>1667 (49)</td>
<td>145(34)</td>
<td>976(49)</td>
<td>19(54)</td>
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<tr>
<td>OIH classification</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Class I</td>
<td>1417 (42)</td>
<td>138 (33)</td>
<td>842(42)</td>
<td>74(51)</td>
</tr>
<tr>
<td>Class II</td>
<td>1957 (58)</td>
<td>285 (67)</td>
<td>116(58)</td>
<td>72(49)</td>
</tr>
</tbody>
</table>

*p-Value calculated using chi-square test
and bridge related treatment (12%). The trend in the type of services that were carried out, mostly restorations and extractions, compared favorably with other international studies. However, the quantity of services carried out in the current study was much higher in relation to other similar studies.

Many of the soldiers who had been deemed dentally fit, returned within 12 months of their screening having a decayed or broken tooth that required a restoration. This could imply that soldiers had presented with initial or secondary caries at the time of screening but the attending dentist either did not diagnose the condition appropriately or underestimated the potential for it becoming an emergency within 12 months.

Just over 10% of the soldiers required extractions, possibly because severe carious lesions and/or poor endodontic and/or periodontic conditions had not been identified as potentially emergency conditions.

The difference between the types of dental emergency procedures performed between the two OHF categories was significant. In general, the soldiers who were classified as OHF II required more dental emergency procedures than those classified as OHF I. The OHF II classification is defined as “dental treatment is required but the condition is not expected to cause a problem within the next year”, but nevertheless, the group was more susceptible to experiencing an emergency. These results were confirmed by other studies.

Soldiers who were classified as Whites required mostly restorative services while Blacks required mostly extractions. In South Africa, before 1994, dental services and health care were rationed according to racial lines with Blacks being offered fewer services compared with Whites. The situation with regard to distribution of health services is improving but there are still areas with no immediate access to health services. The fact that more extractions were required by Black military personnel is perplexing considering that everybody in the military has access to the services. There may be several possible reasons why this is so, but certainly there is a need for continuous oral hygiene instruction and enhanced dental awareness amongst all the soldiers.

Non-Commissioned officers required more services than other ranks. These were the young soldiers who perhaps had the highest burden of dental decay and periodontal treatment compared with more senior soldiers who had been in the military for a longer period and may previously have received initial treatment. This result is consistent with a similar study which reported that enlisted submariners (equivalent to non-commissioned offices) were around two times more likely than senior officers to have a dental emergency. The concern with non-commissioned officers requiring more dental emergency procedures are that these are the soldiers who are tasked to carry out the majority of the work and are most likely to be deployed. These officers carry weapons and are more in the front lines as compared with other ranks. Their enforced removal with dental problems from deployment could result in mission failure.

Generals and senior officers as a group received more crown and bridge related treatments (45%) than the other ranks. This was expected as most of them are older soldiers and as a result may have more prostheses compared with their younger counterparts.

The prevalence of dental emergency procedures increased with age, with the 20-30 year olds requiring the least amount of dental services. This finding is consistent with other studies which indicate that caries is an age dependent phenomenon that increases with age and hence as soldiers got older, their dental requirements, as a result of dental caries, increased as well.

LIMITATIONS

The prevalence of smoking and history of any smoking habit was not included in the patient records; hence it could not be assessed as a confounder. Other studies have reported that smokers were five times more likely to have a periodontal emergency and almost two times more likely to have a dental emergency compared with non-smokers.

The study extended for a single year and was too short to detect any changing trends over time. Other projects are currently being planned to determine the changing patterns and disease burdens presented by soldiers.

This study was carried out in Gauteng and may not be representative of the SANDF dental profile. Further studies are currently underway in different provinces to enable across the country comparisons and to identify high risk areas and soldiers.

CONCLUSION

The prevalence of dental emergency procedures among OHF I and II soldiers was relatively high and consisted predominantly of restorations, extractions and crown and bridge related issues. There were significantly more dental emergency procedures performed on OHF II, older and junior ranking soldiers than their counterparts. There were significantly more dental emergency procedures performed on Whites and Blacks compared with other races. The dental emergency profile was influenced by the OHF classification, rank, age and race.

It is recommended that studies must be carried out in different provinces and over a longer period of time to identify high risk areas and common emergency dental procedures.

Acknowledgements

The Surgeon General of the South African Military Health Service gave permission for the study. Brigadier General Derik Janse van Rensburg, director Oral Health, facilitated access to the records and offered encouragement. Military Intelligence of the South African National Defense force gave clearance for the publication. Professor PJ Van Wyk gave guidance throughout the study. All are therefore hereby acknowledged for their contributions.

References

Analysis of the need for, and scope of training in, maxillo-facial prosthodontics in the South African dental technology programme

ABSTRACT

**Purpose:** To investigate the need for additional training for dental technologists in the field of maxillo-facial prosthodontics (MFP), and to try to seek consensus on the scope of that training.

**Method:** There were four phases: Phase 1 investigated current curricula; Phase 2, completion of questionnaires by students, qualified dental technicians and technologists, and clinicians; Phase 3, interviews with the Heads of the three Universities of Technology and the Heads of the department responsible for MFP at the four Dental Schools; and Phase 4, a Delphi survey amongst technicians and clinicians using questions derived from the previous phases.

**Results:** There was widespread agreement that the current dental technology curriculum did not cover sufficient aspects of MFP to provide graduates with the required skills, and that a postgraduate course should be initiated. However, technicians agreed whilst clinicians were against, whether a maxillo-facial technologist should be permitted to work with patients and carry out clinical procedures. There was general consensus that a one-year full-time course was required.

**Conclusions:** A postgraduate course should be instituted to improve the training of dental technologists in MFP. The South African Dental Technicians’ Council should initiate workshops to determine the curriculum, and the regulation of the maxillo-facial technologist.

**Keywords:** maxillo-facial prosthodontics; dental technologist; scope of practice; education and training; postgraduate course

INTRODUCTION

Craniofacial defects are severely debilitating, both physically and psychologically and the provision of rehabilitation prostheses can make enormous differences to the quality of life of the patient. The support of the entire team of health care providers before, during and after surgical treatment and rehabilitation, is required and appreciated by afflicted patients.

In South Africa there are three Universities of Technology: Durban University of Technology (DUT), Tshwane University of Technology (TUT) and Cape Peninsula University of Technology (CPUT). These three Universities train dental technicians (via a three-year qualification leading to a National Diploma) and dental technologists (via a four-year qualification leading to a B-Tech degree). The question arises as to whether adequate training in MP is provided.

Maxillofacial Prosthetics is defined by the current Glossary of Prosthodontic Terms as follows: “The branch of prosthodontics concerned with the restoration and/or replacement of the stomatognathic and craniofacial structures with prostheses that may or may not be removed on a regular or elective basis.”

A maxillo-facial prosthesis (MP) is defined as: “any prosthesis used to replace part or all of any stomatognathic and/or craniofacial structure”. An editorial note stated that “the taxonomy for maxillo-facial prostheses may include modifiers (adjectives) to provide descriptive evidence of the nature of the prosthesis including anatomic location, retention, support, time, materials, and form. Frequently, the means of retention is used, and may encompass descriptive adjectives tissue such as the adjacent tissue, teeth, dental/craniofacial implants, or a combination of such, thus appropriate terminology can include: tissue retained MP, tooth retained MP, implant retained MP, tissue/implant retained MP. Descriptive terminology may also be included to delineate time utilization for the prosthesis such as surgical, interim and definitive.”

In the field of dental technology there has been controversy concerning the issue of dental technicians working directly with patients. A category of Clinical Dental Technologist...
was provided in the Dental Technicians Act (19 of 1945 as amended in 1979) for the treatment of edentulous patients only, but regulations putting this into effect were never promulgated. The present study is concerned with those dental technicians who provide a service, possibly involving clinical input, for patients requiring maxillo-facial prostodontic rehabilitation.

Internationally, there are programmes which specifically train dental technicians in the field of maxillo-facial prosthodontics (MFP) who are then permitted to deal directly with patients. A good example is that of the UK, where dental technicians may be involved in the treatment of patients requiring MFP. At Kings College, London, Maxillo-facial and Craniofacial technology forms a two-year Masters programme open to dental technicians and to dentists, and both are registered with the General Dental Council (GDC).

In the US the situation is similar, where such persons form a specialty of dental technology referred to as Anaplastologists, and many of the members of the International Anaplastology Association (IAA) have advanced academic degrees in medical, dental, and allied health fields. The majority have an extensive art background in addition to their scientific knowledge and profession. However, they are permitted to work directly with patients only on extra-oral appliances.

In South Africa, maxillo-facial prosthetic services are mainly provided at the four dental schools, and by a few private prostodontic practices. Very few dental technicians/technologists in the country are trained or provide technical services in this field. Certainly at the dental schools there are long waiting lists and high workloads and there is clearly a need for such services to be expanded within the scope of dental technology and in the three Universities of Technology.

There are two inter-related aspects to this specialised field of MFP. The first is the adequacy of the training in this field, and the second is the question of whether there should be direct patient contact by the dental technologist. The aim of this study was to address these two challenges and to determine whether it is possible to reach consensus amongst the relevant role-players for solutions which may improve the services rendered to the increasing numbers of patients who require maxillo-facial rehabilitation.

**METHOD**

A survey research design was conceived involving both quantitative and qualitative techniques in which questionnaires were to be distributed and follow up interviews conducted where necessary. Ethical clearance was obtained from the Research Ethics Committee of the Tshwane University of Technology, clearance reference number REC 2012/10/021. Following analysis of the results of these surveys, a questionnaire to be used as a Delphi study was devised. The study population included all specialist prosthodontic dental educators in South Africa, registered prosthodontists, prosthodontic registrars, the Heads and staff of the Departments of Dental Technology in the Technical Universities, registered dental technicians/technologists, and dental student technicians/technologists. (A note on terminology: a dental technician refers to a person who obtained a National Diploma in three years, and a dental technologist as one who obtained a BTech degree in four years.)

The study comprised four phases:

**Phase 1: Curricula**

The three Heads of Dental Technology were contacted and requested to provide their respective curricula. These were analysed to determine the timing and scope of training in maxillo-facial prosthodontics currently being undertaken.

**Phase 2: Questionnaires**

All questionnaires were piloted to improve the validity of the questions. The study populations were sent correspondence via e-mail, explaining the study and requesting their participation. All respondents were requested to complete the questionnaires via the Survey Monkey website, as this ensured the confidentiality and anonymity of the data. However, if respondents felt more comfortable with responding via e-mail, then confidentiality was assured by the anonymous transference of data. At least two follow-up e-mails were used to encourage a sufficient sample of at least 15% of the population.

**Phase 3: Interviews**

One of the authors (KPMT) visited each of the three Universities of Technology, having previously requested personal interviews with the Heads of the Departments of Dental Technology and the Heads of the Departments of Prosthodontics in each of the dental schools. Interview questions were structured around the questionnaires, and the interviewees’ opinions on the current training, scope of practice, and possible future alternatives. The responses helped to form the basis of the questions and statements which were to be used in the Delphi study.

**Phase 4: Delphi study**

The Delphi technique is a method of obtaining consensus amongst a group of experts. First used and described by the RAND Corporation in the 1950s for technological forecasting, it is named after the Pythia, the High Priestess of the Temple of Apollo at Delphi, Greece. It is a technique which seeks to obtain group consensus by combining the opinions of participating experts who are responding to a series of questionnaires. The participants remain anonymous. The results of each round of questionnaires are fed back to the experts who are then again asked their opinion on any modifications that may have been made to the statements as a result of the previous round, and this process is repeated for two of three iterations. In this study, all statements receiving 70% or better agreement in the first round were accepted, and the remaining questions were re-formulated and similar agreement sought. It was found that sufficient consensus was obtained after two rounds, and a final proposal for training needs, the scope, and manner of MFP technology was formulated.

Data were analysed in SPSS (Statistical Package and Service Solutions Inc, Chicago, USA). A p-value ≤ 0.05 indicated a significant statistical difference at a 95% confidence interval. Cross tabulations, Pearson Product-Moment Correlation and descriptive statistics were used to analyse the data. Validity tests and reliability tests were also performed.

**RESULTS**

**Phase 1: Curricula**

Of relevance to this study are the topics in MFP, but unfortunately the curriculum documents received from DUT and CPUT did not specify particular details. It was assumed that maxillo-facial prosthetic topics were
subsumed within the course “Dental Technology 4” in the last year of study, at least for CPUT. Students at DUT, however, confirmed that maxillo-facial prosthetics was not part of their curriculum.

Tshwane University of Technology has advanced subjects which form part of the BTech degree, and which include the manufacture of obturators, splints, hearing aids, and mouth-controlled appliances for disabled persons. However, the students reported that only two aspects are covered: the manufacture of an artificial eye, and obturators.

Phase 2: Questionnaires
The three Heads of Technology and the four Heads of Prosthodontic Departments all responded. Seventy percent of the dental specialists/registrars responded (21 out of 30), 60% (48 out of 88) of the dental technicians/technologists and 86% (215 out of 250) of the students. A large amount of data were collected for each of the groups, although not all will be included in this report for reasons of space. Of most interest are the areas where it was felt that opinions would help influence future outcomes and policies, and therefore data from the groups of respondents were pooled to investigate any trends in frequency distribution. In addition, comparisons between the responses of the clinicians and the dental technicians / technologists were carried out.

Pooled data
For pooled data only the responses of the Fourth Year dental technology students were included with that of the dental technicians / technologists, specialists and registrars, as it was felt the more junior students would not have sufficient insight and might therefore skew the outcomes. The areas investigated were:
• the need for training in maxillo-facial prosthodontics;
• the length of any additional training;
• where that training should take place;
• whether it should be a specialty of dental technology;
• the question of clinical contact of the maxillo-facial technician with patients;
• which statutory body should regulate maxillo-facial technicians should they be permitted patient contact.

The need for training in maxillo-facial prosthodontics and the length of training
Data were available only from the dental technicians/technologists, specialists and registrars, of whom 64% agreed that there was a need for training but were divided on the length, with the majority (59%) stating it should be of one year’s duration.

Where additional training should take place
Data were available from all three groups, but the results were inconclusive: 46% felt it should be at both a Dental School and a University of Technology, 31% felt it should only be at a University of Technology, and 23% only at a Dental School.

Whether maxillo-facial prosthodontics should be a specialty of dental technology
Data were available from all three groups: 80% agreed that it should be a specialty.

The question of clinical contact of the maxillo-facial technician with patients
Data were available from all three groups, and 74% felt that there should be clinical contact with patients.

Which statutory body should regulate maxillo-facial technicians if they should be permitted patient contact?
Data were available from all three groups, and the majority (57%) felt there should be joint regulation between the HPCSA and the SADTC.

Comparative Data
For the comparative data, the responses of the Fourth year dental technology students were included with the dental technicians / technologists and compared with those of the specialists and registrars. The areas investigated were:
• the question of clinical contact of the maxillo-facial technician with patients;
• the length of any additional training;
• where that training should take place;
• which statutory body should regulate maxillo-facial technicians if they should be permitted patient contact.

The question of clinical contact of the maxillo-facial technician with patients
Responses to the two relevant questions are shown in Table 1. The term ‘Technicians’ refers to the Fourth year students and the dental technicians/technologists; the term ‘Clinicians’ refers to the specialists and registrars.

The length of any additional training
The comparative responses are shown in Table 2. In this case, the responses excluded the students of dental technology.

| Table 1: Comparative responses to questions relating to clinical contact |
|--------------------------|----------------|-----------------|------------------|-----------------|
| Should the maxillo-facial technician be allowed to work with the patient and carry out clinical procedures |
|                         | YES | NO  | DON’T KNOW | χ² | p-value |
|--------------------------|----------------|----------------|-----------------|-----------------|
| Technicians              | Number | %    | Number | % | Number | % |
|                          | 34 | 71 | 10 | 21 | 4 | 8 |
| Clinicians               | 5 | 26 | 10 | 53 | 4 | 21 |
| χ²: 11.09 | p-value: 0.004 |
| Should the maxillo-facial technician be allowed to work on patients independently |
|                         | YES | NO  | DON’T KNOW | χ² | p-value |
|--------------------------|----------------|----------------|-----------------|-----------------|
| Technicians              | Number | %    | Number | % | Number | % |
|                          | 27 | 56 | 19 | 40 | 2 | 4 |
| Clinicians               | 0 | 0 | 15 | 83 | 3 | 17 |
| χ²: 17.69 | p-value: <0.001 |

<p>| Table 2: Comparative responses to the question relating to the length of any additional training |
|--------------------------|----------------|-----------------|-----------------|</p>
<table>
<thead>
<tr>
<th>6 MONTHS</th>
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<td>%</td>
<td>Number</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>22</td>
<td>28</td>
</tr>
<tr>
<td>Clinicians</td>
<td>0</td>
<td>0</td>
<td>8</td>
</tr>
</tbody>
</table>
Where additional training should take place
The comparative responses are shown in Table 3. There was a statistically significant difference ($\chi^2=11.48, p=0.003$) in the overall responses between the technicians and clinicians.

<table>
<thead>
<tr>
<th></th>
<th>DENTAL SCHOOL</th>
<th>UNIVERSITY OF TECHNOLOGY</th>
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<tr>
<td></td>
<td>Number</td>
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<td>Number</td>
</tr>
<tr>
<td>Technicians</td>
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Which statutory body should regulate maxillo-facial technicians if they should be permitted patient contact?
The comparative responses are shown in Table 4. There was a statistically significant difference ($\chi^2=17.46, p<0.001$) in the overall responses between the technicians and clinicians.

<table>
<thead>
<tr>
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</table>

Phase 3: Interviews
Universities of Technology: Heads of Department: summary
The Heads of Dental Technology seemed to agree that currently the syllabus or training does not equip the students with the full scope of MFP. The syllabus aimed to provide basic training, but only to a limited degree. The Heads agreed that MFP should be an elective course for those students who want to pursue this field and that successful candidates should become specialised maxillo-facial prosthetists. However, all expressed concerns about the cost implications for a postgraduate course.

Heads and Specialists in the Dental Schools: summary
There was common agreement that a full-time specialised course for maxillo-facial technicians was necessary and that this would help cope with the obvious need. All clinicians felt that the maxillo-facial technician should have some clinical exposure and knowledge, but when doing clinical work this should be done together with the prosthodontist and not independently.

Phase 4: Delphi study
Questionnaires were sent by email to each of the Universities of Technology as well as to technologists known to be active in the field. Nine questionnaires were sent out and four responses were received (44%). One was from a University of Technology Head, one from a technician working in a Dental School, and two from technicians active in making maxillo-facial prostheses. To target prosthodontists, 46 questionnaires were sent out to each of the dental schools as well as to members of the Academy of Prosthodontics of South Africa. Nineteen responses were received (41%) from the first round, and 18 from a second round. All responses were entered anonymously into an MS Excel® spreadsheet, including all the comments received.

Conclusions from Round 1
An extraordinary level of agreement was reached in the responses to certain questions. Delphi studies generally regard an agreement of more than 70% to be at a level sufficiently high to inform practical application to the issue in question. There was general consensus on a wide variety of issues (see Discussion) but some did require further exploration in the second round.

The main area where there was no clear consensus was the whole issue of clinical training and clinical contact for the maxillo-facial technician. Although Round 1 demonstrated agreement that the postgraduate training should not include clinical training, the respondents were divided on the issue of patient contact and team work with a clinician. The question needed further exploration to obtain clarity and to try to obtain consensus amongst the respondents. Therefore the relevant questions for Round 2 were re-formulated with regard to all the responses and comments from Round 1, sometimes to clarify those responses, sometimes to obtain more detail, and sometimes to seek consensus when there was none.

Round 2
The respondents were given the information of the results from the first round as a preamble to this second round. The reformulated questions were designed to provide greater clarity and perhaps to give guidance to what should be included in the postgraduate curriculum.

DISCUSSION
No evidence of studies on this topic could be found for South Africa, and it became clear that there is very little information available as to the extent of the need for maxillo-facial prosthetic rehabilitation throughout the country. Further investigation is warranted.

Encouragingly, 68% of the students reported they were interested in MFP. Of the 205 answering positively to this question, 72% would take an expanded course in MFP if it were to be offered immediately after qualification. Most, though, preferred to follow a part-time course, probably understandable after four years of study. The Universities of Technology should take note of this opinion. Most student respondents also agreed with the notion that MFP should become a specialty of dental technology. The responses of the dental technicians and dental technologists largely reflected those of the students. The majority (84%) expressed a need for further training, stating that their training had been inadequate and 75% felt MFP should become a specialty of dental technology.
Although 81% of the dental technicians / technologists felt that they should be allowed to carry out direct clinical work, only 56% felt this could be done independently of the clinician, which perhaps is an expression of an understanding of the complexities (and complications) of independent clinical practice. The clinicians reflected this to a greater extent, as none agreed that dental technologists should carry out clinical work independently from the clinician. Given the inexperience of the technicians in this field and the experience of the clinicians, this result may not be so surprising. This would also have implications as to how the maxillo-facial technologist should be regulated, as clearly contact with patients would have to be regulated by the Health Professions Council of South Africa.

There was a 64% agreement amongst all respondents that there was a need for postgraduate training in MFP for dental technologists and 59% considered this should be a one year full time course. Amongst the combined group of dental technology students and the technicians / technologists, 80% agreed that MFP should become a specialty of dental technology.

The Delphi survey proved to be a very useful method to obtain consensus on a number of aspects but especially on what should be included in a postgraduate specialty course. Although many Delphi surveys accept a majority rating as agreement, it was felt that for this survey, 70% or better agreement would be representative of a need for change. A high level of agreement was reached to many of the questions from the first round which enabled formulation of the questions for the second round. Once again a high level of agreement was reached, thus obviating the need for a third round. The following are the positive statements which have been derived from both of the rounds, having 70% or better agreement:

- Training in maxillo-facial prosthodontics should be included in the undergraduate curriculum for dental technologists, but only at a basic level and only for the following:
  - An intra-ocular prosthesis
  - An extra-ocular prosthesis
  - A nasal prosthesis
  - An auricular prosthesis
  - A maxillary bulb obturator prosthesis
  - A speech appliance
  - A cleft lip appliance

- Further training should be at the postgraduate level as an additional course and this should be done jointly with a Dental School.
- After receiving postgraduate training, the maxillo-facial dental technologist should be present where applicable in the clinical environment to assist the clinician.
- The maxillo-facial dental technologist should be permitted to place extra-oral appliances on their own without a clinician being present.
- The maxillo-facial dental technologist should be permitted to assist the clinician with the placement and adjustment of intra-oral appliances, but should be permitted only to adjust them out of the mouth and should not be permitted to work directly on the patient.
- Postgraduate training should include observational exposure of surgical procedures in the disciplines of Maxillo-Facial and Oral Surgery, ENT, and Plastic Surgery.
- The following should at least be included in the postgraduate training:
  - An intra-ocular prosthesis
  - Theoretical training in 3D radiography
  - An extra-ocular prosthesis
  - A nasal prosthesis
  - An auricular prosthesis
  - A maxillary bulb obturator prosthesis
  - A speech appliance
  - A cleft lip appliance
  - Surgical obturators
  - Mandibular defect appliances
  - Implant-supported prostheses
  - Training in software for digital planning
  - Training in the use of Rapid Prototyping
  - The science of the dental materials used in maxillo-facial prosthodontics

- If the postgraduate trained maxillo-facial dental technologists can have clinical contact with patients, regulation should be by both the SADTC and the HPCSA.
- If the postgraduate trained maxillo-facial dental technologist cannot have patient contact, regulation should be by the SADTC only.

CONCLUSIONS AND RECOMMENDATIONS

The consensus statements derived from the Delphi survey were largely in accordance with the questionnaire survey results, with the exception of the question of clinical contact. This was largely due to the fact that the Delphi respondents included more clinicians than technicians, and that the questionnaire responses showed that the technicians were more in favour of clinical contact.

All however, strongly agreed on the need for improved training in MFP at the undergraduate level and, more importantly, on the need for postgraduate training.

At present, there is no postgraduate training in dental technology, and although there is legislation which allows for a category of “clinical dental technologist” this was only for the treatment of edentulous patients.

Based on this, and the results from this study, the following conclusions and recommendations can be made:

1. There should be better communication between the Universities of Technology to (a) ensure a common curriculum with respect to maxillo-facial prosthodontics and (b) to open discussions on a postgraduate course.
2. A postgraduate course in maxillo-facial prosthodontics should be instituted, either as a full-time course or twice the length as a part-time course. This could result in a certification or a Diploma or even eventually as a recognised specialty of dental technology. This should be done in conjunction with the Dental Schools.
3. The course should include all the topics derived from the consensus reached in this study.
4. It is recommended that the South African Dental Technician’s Council provides resources so that workshops may be initiated with the following role-players and stake-holders:
a. The three Universities of Technology  
b. The four Dental Schools  
c. The South African Dental Technician’s Association  
d. The South African Dental Association  

The workshops should have the mandate to endeavour to define the curriculum; to decide on the scope and time required for a postgraduate course in maxillo-facial prosthodontics; to recommend regulations pertinent to the maxillofacial technologist; and to advise on a joint training programme including clinical observation and extra-oral contact.

Acknowledgements  
The authors are most grateful for all the participants in this study for having taken the time and trouble to answer the questionnaires and to proffer their suggestions for the Delphi process. Thanks are due to Prof A Toriola of the Department of Sport, Rehabilitation and Dental Sciences, who assisted with the initial planning, sourcing of funding, and compliance with the requirements of the Tshwane University of Technology. Mr TS Ntuli assisted with the statistical analysis.

References  
ABSTRACT
Fissure sealants are considered to be amongst the most effective, least invasive, primary preventive measures against occlusal caries, but surprisingly are not that commonly used. This cross-sectional comparative study evaluated the retention rate and effectiveness in preventing caries of resin-based (RB) fissure sealants that were placed on the occlusal surfaces of the first permanent molar teeth under field conditions on Grade One learners in a rural low socio-economic area community. The control population was a matched sample of Grade Two children. Dental caries and sealant retention were determined by a calibrated examiner who was not involved in the placement of the sealants. On the 12 month follow-up, the caries incidence rate on fissure sealed first permanent molar teeth was 7.1%, while that of the control group was 9.1%, a non-significant result (p=0.39). Sealant retention was also lower than generally reported, only 7.8% being fully intact after 12 months. The placement of resin-based fissure sealants under sub-optimal conditions in the field was not found to be beneficial in reducing the incidence of dental caries. There may be a need for different types of sealant materials to be made available in the public sector for optimal effectiveness.

INTRODUCTION
Dental caries is the most common chronic infectious disease of childhood and poses a serious public health problem in both developing and industrialized countries. The affliction has been on the increase since the beginning of the 21st century, especially amongst children from lower socio-economic communities. In South Africa, many people are poor. The official unemployment rate is 26.7%; approximately one in every three households is living below the food poverty line and more than 80% of the population are dependent on the State for their oral health services. The number of children enrolled in no fee schools in South Africa has increased by more than 70% from approximately 5.2 million learners in 2007 to about 9.2 million learners in 2015. More than two thirds of 6-year-old children suffer from dental caries and more than 80% of these lesions are untreated. In low socio-economic and rural communities, it is often truly difficult for most children to go to the dental clinic for treatment. Time, finances, long distances to clinics and limited availability of transport are real-world challenges faced by many South African children on a daily basis. These difficulties have resulted in many children foregoing preventive and/or curative treatment.

Untreated dental caries results in pain and sepsis and only when the symptoms are severe do many children from lower socio-economic communities seek dental care. In most cases delay in care results in the caries lesion becoming too extensive to restore, resulting in dental extractions being often the most common treatment carried out in public oral health settings. Dental public health treatment data has revealed a significant increase over the past ten years in the number of tooth extraction procedures (often under general anaesthesia) and a decrease in the number of restorations and fissure sealants being done. Untreated dental caries negatively impacts the immediate and long-term quality of a patient’s life. Consequently, a need was identified to urgently reverse these trends in the dental public health sector and to increase the provision of proven preventive oral health strategies such as fissure sealants.
prosthetic procedures is therefore important from a public health point of view.8

Fissure sealants are recognized as one of the most effective and least invasive procedures to prevent and control dental caries and can ensure complete protection and total preservation of the occlusal surfaces of posterior teeth.9 However, despite strong evidence for the safety, effectiveness and cost-efficiency of fissure sealants, their use still remains low.10,11

The placement of fissure sealants is particularly low among school children from lower socio-economic communities in which parents are often unemployed, uneducated, live in low-cost housing and attended public schools.12,13 The social inequality in sealant utilisation is of particular interest as it seems to suggest that those children most in need are least likely to receive dental sealants.14

In an effort to address this inequality, school-based fissure sealant programmes (SBFSP) were introduced and have been shown to be an effective way of increasing delivery of this protective measure. The World Health Organization, Centres for Disease Control and Prevention (CDC) and the Association of State and Territorial Dental Directors (ASTDD) have subsequently endorsed the implementation of SBFSP.15 Programmes that focus on SBFSP are therefore justified due to the cost-saving attributes of fissure sealants, which can benefit from the caries preventive properties of fissure sealants. However, the only sealant available to the children from a low socio-economic area were fully erupted and caries-free (zero baseline level of caries). In some children, not all four molar teeth met these conditions. In such cases, fissure sealants were placed only on the eligible teeth, resulting statistically in an average of 3.56 first permanent molar teeth sealed per child.

No mobile dental truck, portable suction or dental assistant were available. The sealants were placed in the staff room of the local primary school, the dentist working under natural light and making use of the two-handed placement technique. The children were seated on the fold-up dental chair, with no compressed air or suction available. There was no water rinsing or air drying of the occlusal surfaces. The occlusal surfaces of the targeted teeth were cleaned with wet cotton wool pellets and dried with dry cotton wool pellets. Isolation was achieved by placing cotton rolls lingually and buccally of the targeted teeth. The cleaned occlusal surfaces were conditioned by using the self-etch Adper-L-Pop system by 3M ESPE. The self-etching liquid was applied with the brushes that are standard provision with the system and was cured with a cordless curing light for 30 seconds.

The resin-based Clinpro® fissure sealant (3M ESPE) was applied onto the conditioned occlusal pits and fissures, manipulated with the brush tip to free potential air bubbles and cured for 30 seconds. No rotary instruments were available and therefore no occlusal adjustments were made at the time of placement.

Dental caries was clinically detected by visual inspection according to the WHO guidelines18 and only on children with signed consent forms. Children brushed their teeth before being examined while seated on a mobile dental chair in the classroom. The examiner used a surgical headlight for additional illumination. A mouth mirror, ball-ended dental probe, and a mobile 3-in-1 air syringe for proper drying of the tooth surfaces were used to assist with the intra-oral examination. Prior to the clinical dental evaluations, standardisation and calibration of the examiner was carried out on a group of pre-selected children.

The 2013 exercise was not part of any school Caries Preventive Programme or study, no initial caries screening had been done in a control group and no scientific sampling process was followed.

This study took advantage of the data from that programme and was therefore concerned with investigating the caries preventive effect of a resin-based fissure sealant when placed under field conditions on recently erupted first permanent molar teeth. Hence carious lesions detected at the 12 month follow-up were regarded as “incidence” cases.

The SBFSP programme

The commonly adopted ‘high risk’ approach for the prevention of dental caries in a population was not followed in this programme. A 2006 study showed that ‘high-risk’ children accounted for less than 6% of new carious lesions with the remaining 94% of new lesions coming from those children who were classified as being at lowest baseline caries risk.16 The identification and sealing of “high-risk” children was found in that study to be ineffective in reducing the overall incidence of dental caries in a population.16,17

In the 2013 programme the fissure sealants were therefore placed on the permanent molars of all eligible Grade 1 learners (100) who delivered a signed consent form, irrespective of the child’s individual caries risk or oral health status. Inclusion criteria provided that a child was in Grade 1 and that the first permanent molar teeth were fully erupted and caries-free (zero baseline level of caries). In some children, not all four molar teeth met these conditions. In such cases, fissure sealants were placed only on the eligible teeth, resulting statistically in an average of 3.56 first permanent molar teeth sealed per child.

No mobile dental truck, portable suction or dental assistant were available. The sealants were placed in the staff room of the local primary school, the dentist working under natural light and making use of the two-handed placement technique. The children were seated on the fold-up dental chair, with no compressed air or suction available. There was no water rinsing or air drying of the occlusal surfaces. The occlusal surfaces of the targeted teeth were cleaned with wet cotton wool pellets and dried with dry cotton wool pellets. Isolation was achieved by placing cotton rolls lingually and buccally of the targeted teeth. The cleaned occlusal surfaces were conditioned by using the self-etch Adper-L-Pop system by 3M ESPE. The self-etching liquid was applied with the brushes that are standard provision with the system and was cured with a cordless curing light for 30 seconds.

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Ethical Considerations

The study protocol was granted ethical approval by the Senate Research Ethics Committee of the University of the Western Cape. Informed consent was obtained from the principals of each participating school and from the parents or guardians of the children who were to participate in the study. It was emphasized that strict confidentiality would be maintained at all times and that the parents or guardians could withdraw their child from the study at any time without being penalised in any way. Irrespective of whether they were part of the present study or not, all Grade 2 learners of the participating primary schools received instructions on good oral health behaviour as
well as a toothbrush and toothpaste. Children with any treatment needs were referred to the nearest clinic to have the necessary treatment and for the placement of fissure sealants if appropriate.

METHODS

Control Group
The school chosen as the source of the control group was in close proximity to the school attended by the children on whom the sealants had been placed, and was in the same socio-economic area. On 12 month follow-up the study group had had a drop-out rate of 20%, which resulted in a sample size of 80 children. A systematic cluster sampling process was then undertaken to identify the control group. Matching was done until the control group comprised the same number of children (80).

Data capture and analysis
A structured Microsoft Excel spread sheet data capture sheet suited to the aim and objectives of the study was designed to ensure that it was clear, simple and unambiguous, minimized potential errors by the researcher and coder and enabled efficient and meaningful analysis of the data.

Basic descriptive analyses were done using the Microsoft Excel environment, while further statistical analyses used the statistical computing programme “R”. Several statistical tests were carried out to determine whether any significant differences were present between different elements of the captured data. The Relative Risk (RR) was computed using the Cochrane Software (version 5.2) program for absence and/or caries presence at the end of the observation period of 12 months.

RESULTS

Examiner calibration. The intra-examiner agreement kappa statistic was 0.9083.

At the time of sealant placement in 2013, exactly 100 Grade 1 learners were eligible and received fissure sealants in accordance with the placement criteria. This amounted to 356 first permanent molar teeth that were sealed (an average of 3.56 teeth per child). On 12 month follow-up, the remaining 80 children presented 281 previously sealed teeth to be examined for fissure sealant retention and caries presence (an average of 3.51 teeth per child).

Main results:
Caries incidence rate at 12 month follow-up of sealed versus unsealed teeth:
The caries incidence rate at 12 month follow-up among the RB sealed teeth was 7.1% compared with 9.1% among the unsealed teeth (Figure 1).

RB sealant retention at 12 month follow-up:
Only 22 (7.8%) of the 281 RB treated teeth that were available for assessment had fully intact sealants left. A total of 256 sealants (91%) had already been lost and three of the 281 previously sealed teeth had been extracted during the 12 month period.

DISCUSSION
From a public health point of view, one always needs to be cognisant of the impact that the adopted strategy will have on the total dental health and disease burden of the targeted population as a whole. Therefore, when a SBFSP is conducted, clinicians should also consider caries risk at the level of the school and community, instead of only assessing caries risk at the level of the patient or tooth.
It was subsequently concluded that from a public health perspective, policies for caries preventive strategies should be based on a ‘population’ or ‘directed population’ approach, instead of a ‘high-risk’ approach.26

The caries incidence rate of the unsealed group in the study was 9.1% as opposed to 7.1% in the sealed group. This resulted in a 2% caries preventive effect of the resin-based fissure sealants. These had been placed under field conditions, showed a high loss (91%) over the period of the study and their effect in preventing caries was not statistically significant.

The patient response rate was 80%, a figure acceptable in epidemiological studies.20 The recommendation for placing fissure sealants on molars is that the procedure be completed preferably within the first year after complete eruption and not more than 4 years later than this.4 First permanent molar teeth usually erupt when a child is aged between 6 and 7 years.21 Fissure sealants should therefore be placed on children aged 6 to 8 years, depending on the eruption status of the targeted teeth. In the current study, the average age of children at time of sealant placement was 7 years and 4 months, which falls within the suggested guidelines. Although it is generally accepted that fissure sealants can safely be placed on teeth with early, non-cavitated carious lesions,12,22 all the sealants in this study were placed on caries-free teeth.

Favourable marginal adaptability of the sealants is a primary factor which can influence its caries inhibiting effect. The sealant must form a proper seal to minimize microleakage and marginal gap formation.23 When inadequate fissure sealants are not replaced, secondary caries may ensue.24,25 In turn, microleakage is significantly influenced by the condition of the enamel (sound or carious) and by the location of the caries in the fissures. The problem is generally found to be higher where the borders of the sealants are on carious enamel, where the sealant occlusal length is longer and where the entrance angle between the enamel surface and sealant is larger (shallow fissures).

Microleakage can also occur after fracturing of the sealant (i.e. not fully intact sealant, which can result due to stress or thermodynamic shrinkage of the sealant) and can lead to discoloration, secondary caries, tooth hypersensitivity and pulpitis.24 Paradoxically, when sealants are not placed properly, dental caries may actually increase, instead of the desired reduction.26 Microleakage was also found to be greater in glass ionomer (GI) than in RB sealants.27 However, recent studies have shown that the incorporation of bioactive glass (BAG) into GI compositions has resulted in an improvement of the bioactivity, tooth regenerative and reconstruction capacity of the GI composition.28 GI fissure sealants containing 45S5 bioactive glass, despite some marginal leakage, have been shown to be effective preventive dental materials for inhibiting secondary caries at the tooth/sealant marginal gap area.29

The 7.1% caries incidence rate in the study is almost three times higher than the average of 2.5% as reported in the systematic review by Condé et al.24 However, in that study, all the sealants considered had been placed under ideal conditions. This is relevant for there are fundamental differences between the placement of fissure sealants in a clinical (ideal) versus a non-clinical (in the field/at a school) setting. The two situations are mainly distinguished by assumptions about the availability of diagnostic and treatment options and utilisation of dental care patients.20 In a clinical setting there is a higher likelihood that practitioners can provide a continuous health care service with a comprehensive range of caries diagnostic and treatment options available (i.e. follow-up of fissure sealants with replacement where necessary). This is in contrast to children who are treated ‘in the field’ (i.e. at a primary school as in this study). These children are more likely to be episodic users of primary oral health services, with a reduced chance of receiving follow-up care (i.e. monitoring and replacement of fissure sealants).20

Traditionally, resin-based fissure sealants have been the most commonly used dental sealant material and have been hailed by some as the “gold-standard” in dental sealant materials.31 It has been shown to be successful when placed under ideal conditions (i.e. clinical settings using a four-handed technique) and where follow-up visits can be done. Successful application of a RB sealant involves strict attention to detail and dry field isolation throughout the procedure.32 Hence, the procedure is very technique sensitive and is especially affected by saliva contamination, the most commonly reported reason for RB sealant failure.33 Resin-based dental sealants can only exert a protective effect on an intact tooth surface.34 The four-handed placement technique has therefore been advocated as the best way to ensure clinical success with RB sealants. This technique allows one operator to take control of the field of isolation (preferably with cotton rolls supplemented by portable water and a suction system) while the other performs the steps of the sealant placement protocol.36 The four-handed placement technique was furthermore associated with a nine percentage point increase in sealant retention over the two-handed placement technique (placement of sealants by a single operator).37 In cases where saliva contamination is least likely to occur, such as in a clinical setting with the use of the four-handed placement technique, the choice of either a RB or GI sealant is warranted.38,39

There is evidence that GI sealants should be considered when fissure sealants are to be placed under field conditions where saliva control may be a challenge and no follow-up is planned.40 This may be due to the hydrophilic properties of GI sealants which mean that they do not require an absolutely dry field of placement to be successful. Glass ionomer sealants also contain fluoride ions which are released and taken up by the tooth enamel. This assists in remineralisation of the enamel and thus renders the tooth structure less susceptible to demineralization.41,42 Furthermore, Pardi et al (2003)43 have noted that even after glass ionomer sealants appear to have been lost from the tooth surface, some small amounts can still be found in the pits and fissures and release fluoride which helps in remineralising the tooth enamel. This characteristic of GI sealants seems to suggest that a follow-up and replacement of a GI sealant programme is not as important as is the case with a RB sealant programme. Current clinical evidence furthermore suggests that high viscosity GI sealants are not inferior to RB sealants in terms of caries preventive properties.31 On the contrary, it seems that similar caries-preventive efficacies exist after a period of 48 months and the study
even mentions a possibly superior caries preventive effectiveness of high viscosity GI sealants over RB sealants after 60 months.30 Therefore, when saliva contamination is likely to be a high risk factor, such as in the context and setting of the present study, a GI sealant material would ideally have been the preferred material of choice.31,40

**CONCLUSION**

The present study has shown that under field conditions, and among children, RB sealants are not ideal for caries protection. When one takes into account the context (a young child), the setting (under field conditions), follow-up (or lack thereof) and isolation challenges (saliva contamination) that are associated with a school based fissure sealant programme, materials alternate to resin-based fissure sealants should be considered.

Such appropriate choices should be made available, especially to oral health professionals in public dental clinics, to ensure enhanced effectiveness of the intervention strategy and to reduce the disparities that currently exist in oral health status and access to oral health preventive services.42

**RECOMMENDATIONS**

Interest and attention are increasingly being paid to the application of “smart” bioactive materials in the field of dentistry. The inclusion of a bioactive glass in a GI fissure sealant material is recommended for its potential to assist in the reduction of caries at the marginal gap area, thereby helping to prevent the formation of primary and secondary occlusal caries.43

**LIMITATIONS**

The fact that these sealants were not initially placed as part of any controlled study has resulted in potential sources of bias and limitations. Appropriate sample sizes of the case and control groups could not be statistically determined. No initial caries screening was undertaken for the control group. The researcher also could not conduct a re-examination of the targeted groups due to serious time constraints. Another limitation to all fissure sealant studies is the fact that the sealants themselves may be contributing factors in the development of secondary caries.

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INTRODUCTION

There are four crucial safety criteria for the practice of procedural sedation:
- pre-sedation health status assessment or evaluation,
- the specifics of sedation drugs administered,
- monitoring of the patients, and the
- post-sedation recovery phase, which includes discharge criteria.

No patient should receive procedural sedation if a health status assessment has not been completed.1

DISCUSSION

All international guidelines stipulate, and all professional societies involved in safe sedation practice accept, that sedation can be done safely in the office/surgery, so-called out-of-theatre-facilities, and in conventional in-hospital theatres.2 The question remains, which patients qualify for sedation outside the traditional theatre?

In the USA today, neglecting to follow safety procedures, including adequate pre-operative assessment, is one of the top five causes of litigation against anaesthesiologists.4 If a claim were to be made, the legal perspectives would require that the operator and other attending staff would be assessed on all elements of the procedure including the following: patient assessment, choice of technique, consent, documentation and discharge.5

Any patient must be evaluated as to fitness for sedation, a process involving a medical history questionnaire, a physical examination, and appropriate special investigations where necessary. This article will focus on evaluation of patients with heart and lung disease for possible sedation fitness.

It is internationally accepted that the classification of the American Society of Anesthesiologists (ASA) be applied in the determination of whether a patient qualifies for sedation outside the traditional theatre (Table 1).

Patients with an ASA classification of 1 or 11 are eligible to qualify for sedation in facilities other than hospital or day care theatre.

The ASA classification is limited to the extent that it acts only as a clinical status classification, not as a risk stratification tool. The patient still needs a completed medical history and comprehensive examination of the airway, as well as of the relevant systems (in the case of cardiovascular and respiratory patients, these systems need extra attention).

The medical history questionnaire (MHQ) is a very important adjunct that the sedation practitioner should use in conjunction with a thorough clinical examination. It is not only important for medico-legal purposes, but also for good practice and optimal patient care. This can be filed alongside the sedation notes and kept for future reference. It gives the practitioner an indication of the health status of the patient at the time when the patient completes the form before the operation.

For every sedation case, a new MHQ should be filled out. This will guide patients to accurately report on any recently diagnosed disease eg. heart disease, hypertension, diabetes mellitus, etc. The MHQ should also conclude with an open-ended question, asking for any additional confidential information about which the patient wishes to inform the practitioner. This creates an opportunity for the patient to mention any other drugs or substances used that are not included on the regular form, especially recreational drugs not previously disclosed. These have a high possibility of precipitating drug interactions during and after procedural sedation.

The authors Green and Krauss emphasize the importance of titrating drugs according to clinical effect, thereby achieving the so-called “minimum sedation state”.6 This can only be done if the practitioner knows the specific detail of the patient’s demographics in terms of height, age, weight and gender. It is important to ask for these specifics – the weight gives an indication of the maximum dose of the drug that can be administered. The MHQ should also allow for questions about previous sedations or general anaesthesia, as well as any side effects or complications the patient was made aware of by the then attending anaesthetist.

ACRONYMS

ASA: American Society of Anesthesiologists
DM: Diabetes Mellitus
HTN: Hypertension
MHQ: Medical History Questionnaire

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Medical MHO’s often exclude specific information about the patient’s treating physicians. Names and contact numbers, as well as conditions for which treatment had been prescribed, currently or previously, and a record of hospitalizations in the last five years are often excluded. These are important data enabling adequate assessment of the patient.

The next of kin, the responsible adult nominated to take the patient home and the name and telephone numbers of a person to be contacted in the case of an emergency, should also be recorded in the MHO.

More specific questions about the physiological systems can guide the practitioner as to whether a patient qualifies for sedation in the rooms/facilities: Information on cardiovascular disease is crucial for the sedation practitioner i.e. hypertension, stroke, coronary occlusion, myocardial ischemia, stents, angina. These data will inform the sedation practitioner about possible cardiovascular problems and the possibility of risk of cardiovascular events during the sedation.

Information on rheumatic heart disease/congenital heart disease is not only important as far as antibiotic cover is concerned, but also to confirm the functional status of the patient and to discern whether the patient needs more investigations to determine the level of functionality (for example an echocardiogram, ECG, stress test).

Questions to better guide us on the functionality level of the specific patient’s condition would be, for instance, whether any chest pain is present on exertion, shortness of breath during mild exercise and the ability to climb two flights of stairs without feeling short of breath. Other physical signs or symptoms that patients may experience, pointing to cardiovascular risk, are swelling of the ankles, or the need to raise pillows up to sleep comfortably at night.

Many patients do not regard aspirin as prescribed medication and might neglect mentioning that they are using this daily. The practitioner should enquire about this and about specific cardiac or anticoagulation medication the patient may be receiving in order to decide whether any requires monitoring of the levels or needs to be stopped, in which case whether any bridge therapy should be initiated.

It could be difficult to know about underlying respiratory disease, especially if the patient is asymptomatic. When patients complain of shortness of breath (there may be other reasons for this i.e. obesity), this should alert us to the possibility of underlying respiratory disease, as would also a mention of pain in the chest especially with breathing, and coughing with or without the production of sputum.

If there is sputum production, the colour of the sputum is important. This will give an indication of the possibility of an infectious process in the lungs. If the sputum is yellow or is purulent, the patient may have a respiratory infection, and needs to be referred to their medical practitioner for treatment.

Blood in the sputum may also be a sign of lung disease.

A productive cough may be caused by allergic conditions, but this is a diagnosis that the medical practitioner must make. Wheezing may be caused by uncontrolled asthma. It is not advisable to sedate a wheezing patient.

Chronic, productive cough, weight loss, tiredness or any other symptoms suspicious of chronic disease should alert us to the possibility of undiagnosed tuberculosis which needs investigation and referral.

Remember that elderly patients may be on various drugs for hypertension, coronary artery disease, asthma, bronchitis, and diabetes mellitus. These disease states may influence our choice of drugs for sedation.

Cardio-respiratory signs and symptoms are important determinants of fitness for office-based sedation. When in doubt, rather refer the patient for appropriate investigations or further care and reschedule the sedation and procedure.

**CONCLUSION**

When evaluating a patient for out-of-office procedural sedation, the sedation practitioner is responsible for making an informed decision about the patient’s fitness for the procedure. The practitioner cannot rely on the immediate history alone, but should place reliance on the combination of a detailed history in the form of an MHO, followed by a focused and thorough clinical examination.6

Of great importance is whether the patient has started taking any new drugs, or is experiencing any new symptoms.

**References**

Insights into the clinical effectiveness of whitening products. Part 2
Dentist-supervised-at-home LED gel bleaching product

ABSTRACT
This section of the report is about the success of a dentist-supervised-at home LED gel tooth whitener, giving the results of a clinical study. The product (LED light gel with 44% carbamide peroxide) was applied by the dentist on teeth 11 and 21 in the chair for 10 minutes. The process was repeated three times, followed by an at-home treatment period (30 minutes/day) of 14 days with 35% carbamide peroxide. The treatment was as outlined by the manufacturers. The L* value improved (more white) after the in-chair treatment with the LED system but showed no further significant increase after the 14 day at-home treatment. However, the b* value improved (less yellow), after both the LED treatment and 14 day at-home treatment. The a* value did not improve significantly throughout the treatments. The LED system provides in-chair tooth whitening after a 14 day treatment although not as effectively as does Opalescence.

INTRODUCTION
Tooth whitening or bleaching has become more in demand in the past decade and several methods have been developed. One practised for many years, before the modern peroxide methods, was the use of fine ash to polish/clean teeth to make them cleaner and whiter. Today, tooth whitening can be over-the-counter bleaching (self-administered), in-office bleaching (professionally administered) and dentist-supervised take-home bleaching. Nowadays, tooth bleaching is mainly done with different peroxide concentrations, such as hydrogen peroxide or carbamide peroxide which decomposes to also give hydrogen peroxide. The hydrogen peroxide then forms free radicals like hydroxyl and perhydroxyl radicals, and superoxide anions, unstable reactive oxygen molecules which are transformed to oxygen and hydrogen peroxide anions. Some bleaching products have a low pH (4.0) which would have an etching/damaging effect on the teeth. Low pH products should always be used with considerable caution. Clients today expect to observe tooth whitening directly after a visit to the dentist, an expectation which has led to the introduction of higher concentrations of chemicals and the use of different light sources believed to accelerate the bleaching process through the activation of a catalyst. Many light sources are now available: lasers, uv light, light-emitting diodes (LED’s), halogen lamps and plasma arc lamps. Each of these instruments is supposed to light-activate a specific product which helps with the bleaching process. One disadvantage with most of these lights is that the tooth is heated, while the intra-pulpal temperature should not increase by about 5.5°C. There is still a vast controversy as to the effect of lights in improving the bleaching of teeth. Therefore, the purpose of this clinical study was to determine the whitening effect of a relatively new Light Emitting Diode System. This is one of the lights which are claimed to not increase the tooth temperature significantly.

METHODS AND MATERIALS
Students (ethical approval # 10/3/29) with two sound central maxillary incisors (teeth 11 and 21), in good dental and medical health and not on any medical treatment, were selected for this study. Smokers, subjects with fluorosis and tetracycline-stained or previously bleached teeth were excluded. In accord with the manufacturer’s instructions, the teeth were polished with the Brite White polishing tool and paste, rinsed and blot dried. The LED product (gel with 44% carbamide peroxide) was applied by the dentist on teeth 11 and 21 in the chair for 10 minutes. The process was repeated three times, followed by an at-home treatment period (30 minutes) of 14 days with 35% carbamide peroxide. The colour of the teeth (at the centre of the crown, 6mm
diameter probe) was measured (with a spectrophotometer) just before treatment, after the LED gel application stage and after the 14 day at-home treatment period.

**RESULTS AND DISCUSSION**
In this study the applications were effected in the manner outlined by the manufacturer. Many studies adapt and modify applications for some or other reason but the efficacy of the process needs to be evaluated with due consideration of the possible influence of the adaptations. Comparison of results with such studies is therefore not therefore feasible.

Measuring colour with a spectrophotometer is (for many reasons) by far the best method to use, for colours can then be quantified by numerical evaluation in a three dimensional colour space \((L^*a^*b^*)\).\(^5\) The total colour change (see Figure 1) is expressed as \(\Delta E_{L*a*b*}\) which includes three components, \(\Delta L^*\), \(\Delta a^*\) and \(\Delta b^*\) (The \(\Delta\) shows a value which is the difference between before and after treatment). Hence, \(L^*\) varies from a more black side (negative side) to a more white side (positive side), \(a^*\) varies from a negative side (more greenish) to the positive side (more reddish), while \(b^*\) varies from the more blue side (negative side) to the more yellow side (positive side).

The present LED system has the following specifications\(^4\) (according to the information provided by the manufacturer): a blue LED light (wavelength between 450 and 500 nm) which is claimed to activate their custom made gel which prevents heat formation, is FDA cleared and very successful in tooth colouring (up to 11 shade tabs). It is also claimed to boost the healing of mouth ulcers, cold sores and periodontal diseases.

The results for Teeth 11 and 21 did not differ significantly and therefore the data were pooled for the analysis. The \(L^*\) value improved (more white) after the in-chair treatment with the LED system (LED light and gel with 44% carbamide peroxide with a specific catalyst) with no further significant increase after the 14 day treatment. However, the \(b^*\) value improved (less yellow) after both the LED treatment and 14 day at-home treatment. The \(a^*\) value did not improve significantly throughout the treatments. The total tooth whitening value \(\Delta E_{L*a*b*} = 1.8\) was much lower than the 3.7 which was found for the Opalescence PF 10% (see part 1\(^7\)). The reason could be a combination of factors: in the case of the LED system the original in-chair treatment was 3x10 minutes with the LED light and the gel which also contained 44% carbamide (about 15% hydrogen peroxide). The light (LED) effective catalyst in the gel is probably partially responsible for the quick whitening process. Thereafter the at-home treatment was 30 minutes a day for 14 days with 35% carbamide peroxide (about 12% hydrogen peroxide), while in the case of Opalescence the treatment period was much longer (nightly, 6-8 hours) for 14 days with 10% carbamide peroxide. The longer nightly treatment is probably responsible for the superior whitening effect. Therefore, it seems that a longer daily treatment (overnight; Opalescence) with a low peroxide concentration (10% carbamide peroxide, about 3% hydrogen peroxide) gives better results than a shorter treatment period (30 minutes) with a higher peroxide concentration (LED system). Figure 2 gives an indication of what the visible colour improvement would look like. The original colour measurement was rated as A2.

**CONCLUSION**
This LED system gives relatively low tooth whitening with the main effect \(\Delta E_{L*a*b*} = 1.8\) but that is directly after the 3x10 minute in-chair treatment and there was only an additional insignificant increase \(\Delta E_{L*a*b*} = 0.2\) after the 14 day at-home treatment. The advantage of the LED system is the in-chair effect, although with only half the success of Opalescence \(\Delta E_{L*a*b*} \text{ about } 3.7\). Low gingival and tooth sensitivity scores were also recorded.

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Local anaesthetics in dentistry: A series

ABSTRACT
Failure in local anaesthesia in dentistry is not uncommon with failure rates ranging approximately between 15% and 30%, especially for the inferior alveolar nerve block (IANB). In fact of all the nerve blocks which may be administered in the human body the IANB has the highest failure rate (Malamed, 2012). Therefore, the aim of this series of articles is the discuss some of the causes of failure in local anaesthesia and make recommendations so as to minimize the experience. Current trends like computer controlled local anaesthetic delivery, reversal of soft tissue anaesthesia for patient comfort and “needle free” anaesthesia will be discussed.

INTRODUCTION
In Dentistry, failure of local anaesthetics is not uncommon and is in fact a feature of dental practice. Clinical success of local anaesthetics ranges roughly between 75% and 90 %. The inferior alveolar nerve block records the highest failure rate compared with all other nerve blocks in the human body. Despite the problems in achieving local anaesthesia in Dentistry, there are few studies that have attempted to determine the mechanisms for these failures. In clinical practice incomplete anaesthesia can lead to a painful experience for the patient as well as being a frustrating encounter for the clinician, leading to about 10% of cases having to be postponed. An understanding of the reasons for failure could help to reduce its occurrence. Thus, the aim of this article is to discuss some of the possible causes of failure in local anaesthesia in Dentistry and to make recommendations which may minimize the problem.

FAILURE OF LOCAL ANAESTHETICS
Lack of success in obtaining complete anaesthesia in dentistry may be related to anatomical, physiological or psychological factors. Anatomical variations at the site of the injection, infection or inflammation at the injection site and medical or psychological problems with which the patient may present, can affect the anaesthetic outcome (patient related factors). Choice of anaesthetic agents, the use of vasoconstrictors and experience of the operator may also influence the success of local anaesthesia, factors related to the operator.

EFFECT OF ANATOMICAL CAUSES FOR ANESTHETIC FAILURES
An understanding of the variations in innervation to the teeth would help improve the dentist’s ability to induce profound local anaesthesia. The trigeminal nerve supplies sensory function to both the maxillary and mandibular teeth. The inferior alveolar nerve, a branch of the posterior division, supplies sensation to all the mandibular teeth on one side as well as to the mucosa of the lower lip and skin over the chin. However, simply blocking this nerve through the traditional inferior nerve block does not guarantee complete pulpal numbness in 30% of the patients. Using ultrasound-guided technique, Hannan et al. showed that a direct hit on the nerve does not guarantee complete pulpal anaesthesia in spite of obtaining 100% lip numbness. Thus, complete lip numbness does not necessarily indicate complete pulpal anaesthesia in spite of obtaining 100% lip numbness. Accessory or supplementary nerve supply to the mandibular teeth, in addition to that from the inferior alveolar nerve, may be a plausible explanation for failed anaesthesia in mandibular teeth. Only 5.4% of patients have no accessory canals while the majority (81%) of patients have between two to six accessory canals. Gupta et al. found accessory foramina in the mandible in 94% of their cases. It may seem that having no accessory canals may be an exception as more often accessory canals may be found in the mandible. When these accessory canals transmit nerve fibres, local anaesthesia may fail as these branches passing through the accessory canals may provide an “escape pathway” for sensation. In addition to the inferior alveolar nerve in the mandible, the lingual nerve, the long buccal nerve, the nerve to mylohyoid, the auriculotemporal nerve and the cervical nerves have been implicated as possible accessory suppliers of sensation to the mandibular teeth. The auriculotemporal nerve, a branch of the anterior division of the mandibular nerve,
may send out filaments as it loops around the condyle. These may enter the lower jaw through a foramen located slightly above the mandibular foramen to supply the mandibular molar teeth (Figure 1). In this instance the dentist will need to inject slightly higher than the traditional inferior alveolar nerve target to be able to block the auriculo-temporal nerve as well. Foramina present in the retromolar region may also provide entry points for filaments of the long buccal branch of the inferior alveolar nerve supplying innervation to the mandibular teeth (Figure 1). A long buccal block or mandibular buccal infiltration may be necessary for complete anaesthesia in such cases.

The mylohyoid nerve originates as a small posterior branch of the inferior alveolar nerve before the latter enters the mandibular foramen. The branch runs along the mylohyoid groove on the medial surface of the mandible to supply the mylohyoid and the anterior belly of the digastic muscles. Some sensory fibres could enter the mandible through the retromandibular foramina and provide innervation to premolar, canine and incisor teeth and occasionally the first mandibular molar. The presence of both Aδ fibres (afferent) and Aα fibres (efferent) in this nerve confirms its mixed nature. Studies indicate the mylohyoid nerve as an alternate “escape route” for pain in the mandibular teeth. To overcome accessory innervation from the mylohyoid nerve, the clinician can deposit anaesthetic solution higher in the pterygomandibular space or infiltrate on the lingual surface of the mandible adjacent to the tooth so as to block the nerve as it enters the mandible on the lingual aspect.

In the upper jaw the greater palatine and nasopalatine nerves may send sensory innervation to the maxillary teeth in which instance blocking of these nerves by injecting palatally will provide complete anaesthesia to the maxillary teeth.

**SUPPLEMENTAL INJECTIONS**

Occasionally traditional techniques of anaesthesia like infiltration and regional block injections may not provide successful anaesthesia especially in endodontics for the so-called inflamed pulp (hot tooth) or irreversible pulpitis. According to the American Association of Endodontics, a recent systemic review to evaluate the anaesthetic success rates of the inferior alveolar nerve block (IANB) injection technique alone or along with supplemental infiltration (SI) technique when used for pulpal anaesthesia of mandibular posterior teeth with irreversible pulpitis, indicated that none of the techniques gave 100% success rate. When inferior alveolar nerve block alone was used only 14-39% success rate was obtained but when supplemental injections were included, success was significantly increased to 50-65% for irreversible pulpitis.

The term intra-ligamentary or periodontal ligament anaesthesia may be misleading as the anaesthetic injected into the periodontal ligament provides pulpal anaesthesia by penetrating the cancellous bone through natural perforations (Figure 2). The anaesthetic fluid spreads along the outer surface of the alveolar plate and under the periosteum, moving into crestal marrow spaces along vascular channels and not through the periodontium by travelling down the length of the ligament, as was previously assumed. Some authors suggest that placing the bevel of the needle to face the alveolar wall increases the efficacy while Malamed advocates that the bevel should face the root as this allows easier advancement of the needle. It is thus now recommended to commence with the bevel facing the root to facilitate penetration and then to rotate the needle to face the bone to increase efficacy. The success rate when periodontal injection is used as a supplement to conventional IANB is 78%.

Intra-osseous injection consists of introducing the local anaesthetic directly into periradicular cancellous bone via specialized systems like Stabident (Fairfax Dental, USA) and X-Tip (X-Tip Technologies, USA). Success rates for conventional inferior alveolar nerve block with supplemental intraosseous injections ranged from 80% with the first injection and increased to 98% with a second intra-osseous injection. Intra-osseous injection can provide profound anesthesia for 60 minutes when used as a supplement in cases of failed IANB.

In approximately 5-10% of mandibular posterior teeth with irreversible pulpitis, supplemental injections, even when repeated, do not produce profound anaesthesia; pain persists when the pulp is entered. This is an indication
for an intrapulpal injection. Onset is usually immediate and no special syringes or needles are required. The disadvantage is that the injection is painful.

CONCLUSION
Accessory nerve supply especially to the mandibular teeth seems to provide an “escape” route for pain and may contribute to failed anaesthesia in the dental chair. In these instances, the dental clinician needs to block these accessory nerve supplies to ensure complete anaesthesia for their patients.

References

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Maxillo-facial radiology case 147

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CJ Nortjé

Below are cases of cutaneous extra oral sinus tracts/fistulas presenting in the maxillofacial region. A proper diagnosis is important and forms a key to the successful management of these sinus tracts/fistulas in the head and neck region.

INTERPRETATION
Fig 1A and B demonstrates an example of an infection of the canine fossa. The infection is commonly caused by the spread of infection from the maxillary canine and premolars. Fig. 1B shows a slight widening of the periodontal ligament space (Red arrow) suggestive of an apical infection. The canine fossa contains considerable connective tissue and fat, which allow accumulation of tissue fluids and pus between. These infections are most often controlled with antibiotics. However if the infection becomes localised, drainage is indicated. In the second case the patient presented for treatment of a lesion of her right mandible (Fig. 2A) which have been present for many months. The cropped radiograph (Fig.2B) demonstrates two root rests of a molar tooth with a draining sinus perforating the cortex (green arrows). After removing the root rests the lesion disappeared spontaneously within three weeks. A diagnosis of a cutaneous odontogenic fistula was made. The third case, a 12-year old boy, presented with a six year history of a septic draining sinus in the right temporal region (Fig. 3A). The patient had had his first infection of the right infra orbital region when he was one day old. Since that time he had five surgical procedures, which included craniotomies of the temporal region as well as a condylectomy for treatment of an ankyloses of the right TMJ. On examination, a 2x2 cm opening was found in the right temporal region; (Fig.3B). The patient could not open his mouth. The cropped pantomograph (Fig. 3C) showed an apical cystic lesion in the 46 region (yellow arrow), previous attempted condylectomy scar (black arrow) and the presence of a temporal sinus tract (blue arrow). The first surgical procedure involved removal of all infected focal areas of dental origin. This resulted in uneventful healing of the sinus tract (Fig.3D). A successful condylectomy was performed a few weeks later. Orofacial fistulas are not common but intraoral sinus tracts due to dental infections are common. If the tooth causing the problem is treated endodontically or by extraction the lesion will resolve.

Reference
INTRODUCTION

Plato talked about the paradox of doing research by stating “If you know what you’re searching for, why do you search for it? If you don’t know what you’re searching for, what are you searching for?” This statement reflects one of the biggest difficulties researchers have, that is, in the formulation of a flawlessly focused research question. Failure to precisely define that question is also one of the most common errors seen by members of any Dental Scientific Research Committee. During the initial planning stages of any study, some form of protocol is needed as a blueprint for the investigation. This consists of various sections, which are all inter-related and thus need to tie up with each other. After selecting a topic, one should be able to present the main research question / hypothesis as one short statement. This is the Aim of the study. The Objectives then expand on the main Aim in the form of a “To do” list, itemizing the sequence of steps that will be followed. The Materials and Method is arguably the most crucial section to scrutinize when deciding on the value, relevance and feasibility of the project. At this stage, six key questions need to all be answered in the affirmative to validate the investigation: Is the method reliable and repeatable? Is it scientifically sound? Is it ethically justified? Is the procedure valid? Will the results be of benefit to patients, society or the scientific community? And will the design answer the research question?

While being aware that the scope and number of topics in dental research is vast, this paper will present examples of problematic research study designs. The flaws will be identified and explained by assessing the investigation in terms of the six questions above. Possible solutions will be suggested to try to improve the study. The examples also serve to illustrate that research need not be technically involved and complicated. There is a wealth of useful information that can be gathered from relatively straightforward studies that are within the reach of clinicians. Such projects can offer valuable clinical advice.

CASE SCENARIOS
Case 1: Non-adherence to manufacturer’s instructions.

Aim: To test the flexural strength of endodontic files after repeated use and autoclave thermocycling.

Design evaluation: The study aimed to test the flexural strength of a sample of endodontic files after they had been exposed to a varying number of autoclave cycles. However, the manufacturer's instructions for the test files clearly stated that they should only be used once. The researchers justified the investigation by stating that “all clinicians use files more than once.”

Reliability and repeatability: The results will be unreliable and indeed of no relevance because these files are being tested on a characteristic for which they were not designed.

Ethically justified: Results will be misleading and the manufacturers may challenge the researcher if negative information is published, for they had clearly stated that the files were meant for single usage.

Validity: By not adhering to recommended handling guidelines the results of this study will be invalid, as these files are not designed to be sterilized.

Benefit of results: These results could be conflicting to clinicians wanting to use this product, as they might presume that the results were actually advocating multiple use up to a certain point.

Answers the research question: Yes and No. The aim has been addressed, however the results may not be reliable or valid, and thus are of no use clinically.

Solution: Strict adherence to all manufacturer’s recommendations is essential when testing materials. The researchers should rather have investigated files that are...
design for multiple usage and noted the point at which the files broke. This could be valuable clinical information for practitioners who could then institute some form of marking procedure for files after each use and ensure they were discarded before reaching the stage where there was a risk of fracture.

Case 2: Secondary use of data.
Aim: To determine the number and type of post-operative complications following wisdom tooth extraction under general anesthesia.

Design evaluation: The study was retrospective and involved collection of patient record files to determine the number and types of complications encountered after extraction of third molar teeth at a particular institution during the preceding five years.

Reliability and repeatability: Many files were missing, data were entered by a variety of clinicians and students, files were incomplete, and not all patients with complications returned for follow-up visits. These results were thus not reliable. Validity: The findings are invalid as they do not reflect the full number or type of complications.

Benefit of results: The data collected may identify some of the common post-operative problems, but will not have sufficient details as to the full extent of the nature of the complications. It will not add any relevant knowledge or be of help to clinicians.

Answers the research question: No.

Solution: Rephrasing the question to investigate the nature of post-operative complications that result in patients returning for follow-up treatment after third molar surgery. Acknowledging in the study the limitations of missing files, incomplete data and non-standardization of entries. The study could provide further ethical benefits to patients by looking at possible ways to improve recall attendance and monitoring of complications. Justification would be strengthened by also addressing the logistical and managerial issues in the department, by looking for ways to standardize and improve record keeping and file storage.

Case 3: Participant bias.
Aim: To determine the effectiveness of sterility procedures in general dental practices.

Design evaluation: The investigators called a number of dentists and asked permission to visit to conduct a study on their sterility procedures. The investigators were correct in gaining informed participant consent – however, this alerted the clinicians to the impending visit and could have prompted them to alter their behaviour.

Reliability and repeatability: The results will be unreliable as there is no way of knowing if the prior warning led to a brief improvement and more stringent practices, and thus the true nature of sterility procedures in practice may never be known.

Validity: Results may not be a true reflection of routine practices.

Benefit of results: Without knowing the true nature of sterility procedures, the investigators cannot determine if there is a real problem and need for improvement, and have no justification to institute any interventions or educational programmes for private practitioners.

Answers the research question: No.

Solution: Deception studies are undesirable and seldom approved, so the researchers could not have ethically conducted this study without the dentist’s knowledge and consent. However, they could have arrived at the surgeries unannounced and gained permission to carry out their investigations at that time. They would have had to guarantee total anonymity and confidentiality of all findings. This raises a different ethical concern. What if they did discover that the practices were substandard and patient’s health and welfare was at risk? They had a moral obligation to provide feedback and warn the practitioner of their findings, but were ethically bound to their assurances of anonymity. Post-survey advice would necessitate having some form of contact information, which could only be used if there was complete trust and guarantees of confidentiality from the researchers. In addition, all practitioners could be provided with a written copy of recommended guidelines before conducting the study, so that everyone received the same information and education regardless of the study findings.

Case 4: Researcher bias.
Aim: To determine the durability of a new restorative material.

Design evaluation: The clinician was given a new restorative material to “test” out on patients, and in return was promised a year’s supply for free to use.

Reliability and repeatability: The results will be unreliable and unrepeatable as there is no standardization of the types of cavities in which the material was used. There was also no mention of follow up visits to monitor the durability of the material.

Scientically sound: In material testing there needs to be a clear description of the exact procedures to be followed. In a clinical situation this would entail defining the inclusion criteria for teeth to be filled, such as mentioning cavity site, size, tooth type and position in the arch. There also needs to be specification of conditions that warrant exclusion, if any exist, and justification for their omission.

Ethically justified: The patients may not have been informed that a test material is being used in their mouths. In addition they are being charged for the service and the material while the dentist has received this for free. One also has to consider the possibility that the material may not last. This would result in inconvenience and wasted time and costs for many patients who would have to return to have the fillings replaced. How would the dentist explain the failures to them?

Benefit of results: These results could be misleading to other clinicians wanting to use this product as there was no long term follow-up reports. Results would be based purely on personal preference and ease of handling.

Answers the research question: No.

Solution: Firstly, the clinician should have established if there were peer-reviewed scientific trials recommending
the use of this material before agreeing to take part in the study and exposing patients to the new product. The trials could then be conducted on a statistically determined random sample of patients, all having different sized lesions. Ideally a third person should evaluate the restorations at the subsequent recall visits. Patients should also be made aware that a new material was being evaluated.

Case 5: Mis-interpretation of data, leading to statistical “lies”.
Aim: To determine the incidence of smoking amongst medical students.

Design evaluation: The study looked at final year medical students at one university, but managed to interview only 40 subjects on that particular day (out of a class of over 200). The data collection was accurate, however its interpretation and presentation was totally misleading. One question asked respondents to state their race. There was one Indian male student in the class that day, who also happened to smoke. In the research write up, it was reported that 100% of Indian medical students smoke!

Reliability and repeatability: The results may be unreliable if the sample size was too small and not representative of the entire class.

Scientifically sound: Statistical analysis cannot be performed if the sample is too small or non-representative. Results need to be analyzed and interpreted with caution. Technically, one out of one is 100%, but when presented as a conclusion that is very misleading. Beware of how easy it is to make statistics lie. “They say that 50% of marriages will fail. Thus statistically, either you or your partner will get divorced”.

Ethically justified: Results will be misleading and could cast an aspersion that all Indian medics are smokers. This is poor science automatically equated to unethical study in that it is a waste of time and resources for all involved.

Validity: Poor sampling and misinterpretation of statistics is dangerous and results are misleading, making these findings invalid. This also makes the study unethical and futile.

Benefit of results: The results may still be an indication of the proportion of smokers that could be expected in the whole class.

Solution: Unless there is a compelling reason for race to be investigated it should be omitted from routine research studies. This is because of the sensitivities associated with race, as well as the blurred ancestries of many people and ill-defined classification system. In South Africa, when race is investigated as a variable, research participants are asked to report it as “self-identified” race. The researchers should also have indicated how they planned to use this information.

Case 6: Asking leading questions (subconsciously) arrive at the desired answers. (The same applies with regards to posing intentionally misleading questions).
Aim: To determine the effectiveness of an oral hygiene intervention programme.

Design evaluation: The investigators wished to evaluate if their community oral hygiene instruction programme had led to improvement in the oral hygiene habits of the children. They conducted the study by means of a questionnaire to be filled in by the scholars. Examples of questions were: Do you clean your teeth twice a day? Do you use a tooth brush and tooth paste to clean your teeth? Do you use dental floss to clean your teeth?

Reliability and repeatability: The results may not be reliable as the children are being presented with the correct answers, and most would know that it is “right” to answer “yes”.

Scientifically sound: This questionnaire will not reveal the actual practices, whether the intervention has helped change habits, or if the programme has resulted in improved oral health.

Ethically justified: Although a beneficial oral hygiene instruction programme had been implemented, the follow up research was purely for the investigators to gain information about its effectiveness. Any form of non-therapeutic research is difficult to justify ethically (see note below).

Validity: The findings will be invalid in that they will probably not reflect the actual daily habits.

Benefit of results: This design will not establish whether the oral hygiene programme had been effective. At best it will display if the children know what they are supposed to be doing.

Answers the research question: No.

Solution: The manner in which questions are posed can subconsciously lead respondents to answer what they “think” is correct or what they perceive the researcher wants to hear. It would have been better to have more open ended questions such as: How often do you clean your teeth? What do you use to clean your teeth? The scientific value of the study could also have been improved by having a two pronged investigation. Initially all assenting children could have had a simple clinical examination wherein their DMFT scores were recorded, followed by the intervention, which in this case was oral hygiene instruction. At a pre-determined later date their scores could have been re-evaluated to statistically determine whether there had been any improvement. At this second visit the questionnaire would be handed out, and answers linked to the clinical findings. Ethical note: To justify non-therapeutic research, especially in minors, at both screening sessions, those children found to be in need of treatment should have been attended to, or at least referred to the appropriate centres for care.

Case 7: Trying to establish scientific facts based on subjective observations.
Aim: To compare the buccal corridor and smile aesthetics in extraction versus non-extraction orthodontic cases.

Design evaluation: The researchers planned on using retrospective dental records and photographs of orthodontic patients treated with either extractions and banding or non-extractions and banding. Previous studies had reported that the buccal corridor dimensions changed after orthodontic treatment. The researchers thus wanted to assess aesthetics by means of measuring buccal corridor dimensions on pre and post-operative...
photographs to see which treatment modality had the better outcome (according to their evaluation).

Scientifically sound: There was no standardization of the nature, or degree of malocclusion of each patient before treatment. The smile assessment was based on personal preferences and was a highly subjective evaluation.

Validity: There is no scientific basis for the assessment, and as such it cannot be used as a predictor for future treatment procedures.

Benefit of results: These results cannot be used as a guide to orthodontists as only personal opinions are reflected. The notion of “beauty” is also highly individual and strongly influenced by cultural norms and identities, as well as by current media trends.

Answers the research question: No. The results are subjective opinions.

Solution: A subjective analysis can never be used as a basis for future clinical treatment decision making. At best, this researcher could have measured the dimensions of the buccal corridor before and after treatment and reported on if and how this changed for each type of orthodontic protocol. If there was a constant finding of the corridor getting larger / smaller, that may help clinicians plan future cases depending on which outcome was desired.

Case 8: Lack of anonymity.
Aim: To establish registrar’s perceptions of their learning environment.

Design evaluation: A survey was conducted to gather information on how dental registrars perceived the learning environment at each of the four Universities. The questionnaires were anonymous in order to try to elicit the most honest feedback. However opening questions included the following demographic data: University:

Department: Age: Race: Sex: Year of study. Considering how many 28 year old, black females are in the second year of study in orthodontics at the University of Pretoria, one has to question the anonymity?

Ethically justified: Anonymity cannot be guaranteed and respondents may be victimized if their superiors gained access to the results.

Validity: If the respondents felt the slightest intimation that their identities may be revealed they may not respond in a totally honest manner.

Answers the research question: No. The true feelings may not be revealed and thus the real problems will remain unidentified.

Solution: In almost all research, anonymity is desired by participants and should be guaranteed by investigators. Irrelevant data collection that jeopardizes this anonymity is not ethical and will influence the honesty and thus validity of feedback. The questionnaire should have been structured so that there was no possible way for any of the respondents to be identified in order to gain their trust and foster open and meaningful dialogue.

Case 9: Clinical trials using incorrect methods or outdated materials.
Aim: To test the solubility of gutta percha cones with two different solutes.

Design evaluation: The researchers were testing to see which solute was the most effective in softening gutta percha cones, specifically during endodontic re-treatment. In order to cut costs, they conducted the study using old stock that was no longer in use. However, it was later discovered that the material had long passed its expiry date.

Reliability and repeatability: The results will be unreliable and unrepeatable as the material had expired and ideal properties may have changed. The degree of alteration, and its effect on the solubility are unknown.

Scientifically sound: No study can be sound if the product is not used as stated by the manufacturers. This includes adhering to all manufacturer’s directions, such as indications for use; recommended mixing ratios; correct clinical manipulation; and adherence to expiry dates.

Ethically justified: Results will be misleading, clinicians may have clinical failures if they follow the study advice, and manufacturers may challenge the research results. Validity: By not adhering to recommended handling guidelines the results of this study will be invalid.

Benefit of results: These results could be misleading to clinicians when deciding on which solute to use.

Answers the research question: No.

Solution: In all cases where materials and products are tested the results will be invalid if the material is not handled as advocated by the manufacturer. Reporting results based on erroneous experimental designs or execution can mislead clinicians, and even open the researcher up to litigation by the manufacturers. Ensure that research is always conducted according to set standards, using only approved materials and in keeping with recommended guidelines.

CONCLUSIONS
Science and ethics in research are closely linked in a continuous circle. As seen by the examples in this paper, poor science equates to unethical research. If the original study is unethical, then it would be even more unacceptable to replicate it. Research that cannot be tested, repeated, validated or refuted, is invalid and consequently unusable. Studies which cannot be implemented are thus worthless and as such are poor science.

References
A patient suggests fraudulent behaviour

A patient complains that she “hates her partial denture” and wants a ‘porcelain bridge’ just like the one the dentist made for her best friend. Her partial denture is now fifteen years old, is poorly fitting and is not aesthetically pleasing. Her present oral health condition would tolerate either a fixed or removable partial denture. The patient has medical aid in terms of which benefits for prosthodontics is limited to a maximum allowance of R3000.00 per annum. The dentist agrees to send a pre-estimate and authorisation for a fixed prosthesis and couple of weeks later the Scheme rejects the application for authorisation but with a decision that authorisation is given for a removable partial denture.

The patient is upset and insists that the dentist complete the fixed prosthesis and then submits a claim for a removable partial denture. She would then pay the balance of the account. The practitioner explains that this would be illegal and unethical, but the patient again insists that her decision be followed or she will go to another dentist who is willing to oblige. This seemingly simple request by the patient may have serious ethical and legal implications.

This case presents ethical problems relating to (a) several treatment options and informed consent; (b) submission of dental claims and (c) unreasonable requests by patients.

There are two treatment alternatives proposed: fixed or removable partial denture therapy. In other cases, informed consent may involve a myriad of treatment options, the choice of materials, techniques, all compounded by the preferences of the patients.

The above case also provides an opportunity to discuss third party funders and their effect on dental practice. The patient may question the judgement of the dentist if a treatment recommendation is rejected by the funder even though their membership is on the basis of a benefit plan only. More often than not patients do not understand their dental plans or benefit limits. They question why they must pay more for a fixed prosthesis. Most practitioners believe that the patient is entitled to the best dentistry regardless of what his/her Scheme offers, as funders cannot dictate dental treatment, only the benefits allowed.

Patients may request their dentist to mispresent treatment in order to maximise dental benefits, a request that challenges the honesty and integrity of practitioners.

The Health Professions Council’s ethical rules on probity implies that a dentist will, at all times, act with integrity to protect patient and public trust in the dental profession.1

Dental professionalism allows dentists the independence to perform their duties with integrity and can be defined by qualities such as ethical principles of beneficence, respect, integrity, truthfulness and placing the needs of patients first and as “excellence and accountability” (including continuous education and providing health-care services of a high standard).2

These ethical principles should guide the decision-making process and actions of the dentist. Society’s trust in dentists is dependent on the integrity of the individual dentist and the integrity of the dental profession as a whole. If a dentist’s behaviour does not conform to the HPCSA’s ethical and professional code of conduct, it is seen as unprofessional conduct, compromising quality health-care and risking patient safety.

Dentists should also always act with integrity in all financial interactions with patients and medical schemes. The HPCSA states clearly that “health-care practitioners shall not charge or receive fees for services not personally rendered, except for services rendered by another health-care practitioner or person registered in terms of the Health Professions Act (Act No. 56 of 1974), which regulates the particular profession and with whom the health-care practitioner is associated as a partner, shareholder or locum tenens”. The HPCSA also cautions health-care professionals on overservicing patients, referring to unnecessary tests, scans, procedures or care.3

It is important to bear in mind that funders use investigatory probes to identify health-care professionals suspected of fraudulent activities.

Dentists should ensure they act with probity and professionalism when submitting claims and never submit inappropriate, false or inflated claims. If such claims are made intentionally, that is regarded as fraud, in which case even indemnity organisations are unlikely to provide assistance; and the relevant health-care practitioner will also probably be investigated by the HPCSA.

Medical aid fraud is classified as “personal misconduct that does not directly relate to the practice of dentistry”. Nowadays, patients are more informed of their rights and responsibilities and the HPCSA encourages them to report doctors who are unprofessional in their conduct. Furthermore, it is the responsibility of health-care practitioners to report any activities relating to fraud or misconduct.

To protect their independence and the credibility of the profession, dentists should act with professionalism and probity. Unprofessional behaviour should not be tolerated.

References
1. HPCSA, General Ethical Guidelines for the Health Care Professions, Booklet 1.
3. HPCSA, Guidelines on Over-servicing, Perverse Incentives and Related Matters, Booklet 5.

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1. Does post-operative irrigation with drinking tap water reduce inflammatory complications following lower third molar removal?

Surgical removal of third molars is often accompanied by pain, swelling, trismus, and oral dysfunction which normally clears within two to three days. However, wound healing may be delayed due to alveolar osteitis (AO) or wound infection at surgical sites. These complications are accompanied by painful symptoms and exert a significant impact on the quality of life, resulting in loss of productivity and working days for the patient.1

The most common complication following mandibular third molar removal is AO, more commonly referred to as “Dry Socket.” This is a painful debilitating condition that occurs as a complication of tooth extraction in the permanent dentition. There appears to be no consensus on the criteria used to determine the diagnosis of AO. Thus the wide range (1-30%) in the rate of incidence reported in published papers and reviews must be viewed with caution. Generally, though, the signs and symptoms usually occur 1-3 days after an extraction and include features such as postoperative pain (unrelieved by analgesics) in and around the extraction site, a partially or totally disintegrated blood clot within the alveolar socket, halitosis and/or necrotic debris. Various factors have been considered to be associated with an increased risk for developing AO, such as the female gender, smoking, inadequate oral hygiene, surgical trauma, and removal of teeth with pre-existing infection or pathology.1

To support the standard of oral hygiene in and around the tooth socket and to prevent inflammatory complications following surgical removal of lower third molars, some surgeons instruct the patient to irrigate the surgical site with drinking tap water using a syringe. Surprisingly, the efficacy of this simple non-invasive method (unrelieved by analgesics) in or above the tooth socket), this was recorded.


MATERIALS AND METHODS

This multicentre randomized controlled clinical trial was conducted at Nijmegen in the Netherlands. Patients who required third molar extraction were included in this trial. All mandibular third molars were removed under local anaesthesia without antibiotic prophylaxis or pre- and postoperative antiseptic rinses. Intra-operative variables, such as experience of the surgeon, duration of surgery, technique of third molar removal, number and shape of roots were recorded. All patients received a pain diary with a visual analogue scale (VAS) and a validated version in Dutch of Oral Health Related Quality of Life (OHIP-14) forms one day before until seven days after surgery. A review appointment was scheduled seven days after surgery.

 Patients were randomly allocated to one of two groups:

- Monoject® syringe group. After surgery, a curved tip Monoject® syringe (12cm²) was provided to the patient. In addition to the standard postoperative care instructions, the participants received instructions with regard to the use of Monoject® syringe (by bringing the tip at the distal side of the second molar in or above the tooth socket and irrigate four times a day with plain tap water). To avoid early removal of the blood clot, patients were instructed to start irrigating the wound 48 hours after surgery until the first postoperative visit seven days after surgery. Patients were asked to demonstrate how the Monoject® was used. If the patient failed to use the Monoject®, or if the Monoject® was not used according to the instructions (adequate irrigation by bringing the tip at the distal side of the second molar in or above the tooth socket), this was recorded.

- Standard post-operative care instructions, without the use of a Monoject® syringe. The standard postoperative instructions were: biting on a gauze for 30 min, no rinsing and spitting for the first 24 hours, and starting regular tooth brushing the day after surgery, Paracetamol (1000mg, 4 times a day) in combination with ibuprofen (600mg, 3 times a day) were prescribed postoperatively.

The primary outcome measures were the number of lower third molars with postoperative inflammatory complications, which included surgical wound infection and AO. The secondary outcomes consisted of quality of life measures, including pain

ACRONYMS

AO: alveolar osteitis
ITT: intention-to-treat
TR: treatment received

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Surgical wound infection was defined as the presence of a local abscess, onset of facial or cervical abscess/cellulitis, and other signs suggesting an infection (redness, swelling, purulent discharge, fever). The diagnosis of AO was based on the Blum criteria: postoperative pain in and around the extraction site, which increased in severity at any time between one and three days after the extraction, accompanied by a partially or totally disintegrated blood clot within the alveolar socket, with or without halitosis. A distinction was made in patients with more severe symptoms: irradiating pain, which was not adequately relieved by standard analgesics.

The number of post-operative visits and possible postoperative interventions such as wound irrigation, use of antibiotics, abscess incision, and drainage or exploration of the wound within two months were also recorded.

The primary and secondary outcome measures were analyzed with reference to the intention-to-treat (ITT) and treatment received (TR) data. In the TR group, the protocol violations (patients not attending for the postoperative visit one week after surgery and surgical sites not being irrigated according to the instructions) were excluded from analyses.

RESULTS

280 adult patients who together underwent extraction of 333 randomised third molars completed the trial. The majority of the third molars were impacted (68%), which most often necessitated surgical bone removal (76%).

In the Monoject® group, 67 of the 158 surgical sites (42.2%) were not irrigated by the patient according to the instructions and were therefore excluded from the analyses of the TR data.

None of the baseline characteristics differed significantly between the two intervention groups, the ITT and the TR.

The overall incidence of inflammatory post-operative complications following third molar removal was 15.6%. Analysis revealed that these complications developed in 18 cases in the Monoject® group (11.4%) compared with 34 (19.1%) in the control group, a significant difference (Fisher’s exact test, two-tailed, p = 0.04). This was primarily the result of a significantly lower incidence of AO (p < 0.005) in the Monoject® group (5.5%) compared with the control group (15.7%). For the TR analyses, the incidence of inflammatory complications was 8.7% for the Monoject® group and 20.9% for the control group (p < 0.01).

Patients with AO and surgical wound infections following third molar removal had significantly higher pain scores (p < 0.0001) and worse quality of life scores (p < 0.0001) for the first seven post-operative days compared with patients without these complications. Patients presenting with AO and surgical wound infections resulted in a reduced mean mouth opening of 18.2mm compared with a mean reduction of 8.3mm in cases of normal healing one week after surgery. Patients proceeded with work or study after a mean period of 1.7 days in case of normal healing compared with a mean period of 3.3 days in the case of inflammatory complications (p = 0.01).

Multivariate regression analysis demonstrated that the female gender (OR 5.6, 95 % CI 2.2–14.4, p < 0.001), high amount of debris at surgical site (p < 0.001), age >26 years (p = 0.04), resident surgeons (p < 0.02), bone removal (p=0.03), and class III depth of impaction (p = 0.04) were significantly associated with inflammatory complications following mandibular third molar removal.

CONCLUSIONS

The authors concluded that postoperative inflammatory complications following removal of third molars had a significant impact on the quality of life of patients, resulting in an increased number of missed days of work and study. Female gender, increasing age, deeply impacted mandibular third molar, bone removal, less experienced surgeons, and debris remnants in and around the tooth socket were associated with an increased risk to develop these postoperative complications. The incidence of alveolar osteitis following surgical removal of mandibular third molars can be significantly reduced by postoperative irrigation with plain drinking tap water. Starting 48 hours after surgery, using a curved tip Monoject® syringe and rinsing four times a day over five days seems to be an effective protocol for this commonly performed surgical procedure.

IMPLICATIONS FOR PRACTICE

This trial provides evidence of a cheap and readily available method to reduce the risk of complications following third molar removal in the dental chair. However, special care should be provided on the postoperative instructions on how to use the syringe.

Reference
shaping files and three finishing files. A unique design element is varying tapers along the long axes of the instruments. The three shaping files have tapers that increase coronally, and the reverse pattern is seen in the three finishing files.

Post-operative pain is a common sensation after endodontic treatment. Shokraneh et al (2017) reported on a prospective, randomized, double-blind study that sought to compare postoperative pain in patients with asymptomatic mandibular molar teeth with necrotic pulps and periapical lesions, using three different instrumentation techniques: hand, multi-file rotary (ProTaper Universal), and the reciprocating single-file (Wave-One) system.

MATERIALS AND METHODS

This prospective randomized double-blind clinical trial was performed on the first or second mandibular molars of 96 patients aged of 20–45 years referred to a dental hospital in Iran. All the subjects were healthy and had not taken antibiotics or any medications alleviating or altering the pain sensation, such as narcotics, sedatives, and anti-anxiety or anti-depressant agents during the past week. Allergy to anaesthetics, pregnancy, breastfeeding, vital teeth, unrestorable teeth, and teeth associated with pain or swelling were other exclusion criteria. The clinical diagnosis of necrosis was confirmed by no response to an electric pulp test, and the diagnosis of periapical lesion was confirmed by a periapical radiograph. Informed consent was obtained from all the subjects after the nature of the procedure and the possible discomforts and risks were fully explained. A Heft-Parker visual analog scale (VAS) was explained to the patients, and they were instructed how to use it.

Using a block randomisation method, all the patients who agreed to participate in the study were divided into three groups of 32 patients each: Hand instrumentation group (G1), ProTaper Universal instrumentation group (G2), and Wave-One instrumentation group (G3). Allocation was done by a trained dental assistant who was blinded to the study procedures. All the root canal treatments were performed by an experienced endodontist. Ten minutes after inferior alveolar nerve block administration with one cartridge of 2% lidocaine with 1:80,000 epinephrine, each patient was asked whether they had any signs of soft tissue anaesthesia. After adequate anaesthesia was confirmed, the tooth was isolated with a rubber dam, and endodontic treatment was undertaken. Root canal preparation was performed after electronic root canal measurement with a Root ZX (Morita Corporation). The working length (WL) of each root canal was set at 1mm shorter than “Apex” mark of the Root ZX, and this was confirmed with a periapical radiograph.

ACRONYMS

| VAS: | Heft-Parker visual analog scale |
| WL: | working length |

A standardised protocol for obturation and irrigation was used for all patients within each group. Ten minutes after inferior alveolar nerve block administration with one cartridge of 2% lidocaine with 1:80,000 epinephrine, each patient was asked whether they had any signs of soft tissue anaesthesia. After adequate anaesthesia was confirmed, the tooth was isolated with a rubber dam, and endodontic treatment was undertaken. Root canal preparation was performed after electronic root canal measurement with a Root ZX (Morita Corporation). The working length (WL) of each root canal was set at 1mm shorter than “Apex” mark of the Root ZX, and this was confirmed with a periapical radiograph.

A standardised protocol for obturation and irrigation was used for all patients within each group. Ten minutes after inferior alveolar nerve block administration with one cartridge of 2% lidocaine with 1:80,000 epinephrine, each patient was asked whether they had any signs of soft tissue anaesthesia. After adequate anaesthesia was confirmed, the tooth was isolated with a rubber dam, and endodontic treatment was undertaken. Root canal preparation was performed after electronic root canal measurement with a Root ZX (Morita Corporation). The working length (WL) of each root canal was set at 1mm shorter than “Apex” mark of the Root ZX, and this was confirmed with a periapical radiograph.

A 5.25% solution of sodium hypochlorite was used as an irrigant between each instrument during root canal preparation. The smear layer was removed by irrigating with 17% ethylenediaminetetra-acetic acid, followed by irrigation with normal saline solution. The root canals were then dried and filled with gutta-percha and AH-G2 (Dentsply) root canal cement using the lateral condensation technique. The teeth were restored temporarily using a sterile cotton pellet and Cavit (3M ESPE). At the end of the root canal therapy, a single dose of 400mg ibuprofen tablet was administered to each patient.

A trained dental assistant who was blinded to the study procedures instructed the patients to complete a Heft-Parker VAS pain score to rate their pain at 6-, 12-, 18-, 24-, 48-, and 72-h post-operative intervals. No pain, mild pain, moderate pain, and severe pain were indicated by 0-mm, 1–54mm, 55–113mm, and 114–170mm divisions, respectively. The patients were instructed to use mild analgesics (400mg of ibuprofen every 6h) if they felt pain and required pain relief. However, they were also asked to record the number of analgesics tablets on their Heft-Parker VAS forms.

RESULTS

A total of 96 patients participated in the study initially, but three were excluded because they did not return their Heft-Parker VAS forms (two in group 1 and one in group 2). The remaining 93 patients (47 males and 46 females) completed the study, with 30, 31, and 32 patients in groups 1, 2, and 3, respectively. There were no significant differences in age, gender, and type of mandibular molar teeth between the three groups at baseline (P > .05).

There were no significant differences between gender and the level of postoperative pain in the three groups (P > .05). Spearman’s correlation analysis showed no correlation between age and postoperative pain in this study (P > .05, r = 0.28). Cochran Q test showed that in all the three groups, the patients’ pain levels had significantly decreased by 72 h (P < .05).

Kruskal-Wallis test showed that the patients in group Three reported significantly lower postoperative pain levels at 6, 12, and 18 h compared with the patients in the two other groups (P < .05). In addition, the patients in group Two reported significantly lower post-operative pain levels at 6 and 12 h compared with the patients in group One (P < .05). There was no significant difference in postoperative pain between the three groups at the other time intervals (P > .05), although the trend shown by the raw data indicated less pain in group Three.

The mean consumption of analgesics by patients in groups One, Two and Three were 2.43 ± 0.98, 1.22 ± 0.12, and 1.12 ± 0.16 tablets respectively. The consumption was significantly higher in group One (P < .05), with no difference between the two other groups (P > .05).

CONCLUSION

The authors reported that in patients with asymptomatic mandibular molar teeth with necrotic pulps and periapical lesions, preparation of the root canal system with the Wave-One reciprocating single-file instrumentation technique resulted in significantly less postoperative pain and required less analgesic consumption than the multi-file rotary instrumentation technique with ProTaper Universal and hand instrumentation techniques.

IMPLICATIONS FOR PRACTICE

This trial, which used patient-centred measures (Heft-Parker VAS forms), provides evidence of the superior performance of Wave-One for important clinical outcomes (post-operative pain and analgesic consumption).

Reference

CPD Questionnaire

This edition is accredited for a total of 3 CEUs: 1 ethical plus 2 general CEUs

GENERAL

The self-perceived sources of stress among dental students at a South African Dental School and their methods of coping. (p 6)

1. Students reported that sleeping was a major source of relief from their stress.
   a. True
   b. False

2. Dental students reported very similar levels of stress while studying to that reported by age-matched controls.
   a. True
   b. False

3. More dental students in the clinical years had considered suicide.
   a. True
   b. False

Types of dental emergency services provided to dentally fit soldiers in Area Military Health Unit Gauteng, South Africa. (p 11)

4. Personnel who are classified as OHF class I and II meet the criteria for dental readiness and are therefore considered deployable and ready for any operational assignment.
   a. True
   b. False

5. What proportion of the sample developed a dental emergency during the twelve month study?
   a. 14%
   b. 56%
   c. 44%
   d. 31%
   e. 28%

6. The age group of soldiers requiring the least amount of emergency work was:
   a. the 20 to 30 year olds
   b. the 30 to 40 year olds
   c. the 40 to 50 year olds
   d. not defined.

Analysis of the need for, and scope of training in, maxillo-facial prosthodontics in the South African dental technology programme. (p 16)

7. In the USA, Anaplastologists are permitted to work intraorally directly on patients.
   a. True
   b. False

8. There was general agreement that there was a need in South Africa for a course leading to a qualification in maxillofacial prosthodontics.
   a. True
   b. False

9. The Delphi analytical approach was successful in determining positive statements at a level of at least 70% agreement.
   a. True
   b. False

How effective are resin based sealants in preventing caries when placed under field conditions? (p 21)

10. Which of the following statements is not correct?
    Fissure sealants are recognized:
    a. as one of the most effective and least invasive procedures to prevent and control dental caries.
    b. as capable of ensuring complete protection and total preservation of the occlusal surfaces of posterior teeth.
    c. as outlasting any other type of preventive measure.
    d. as being utilised to only a limited extent.

11. The present study has shown that under field conditions, and among children, resin based sealants are ideal for caries protection.
    a. True
    b. False

12. GI sealants have favourable hydrophylic properties and contain fluoride ions which are released and taken up by the tooth enamel.
    a. True
    b. False

Continuous education in sedation: Pre-sedation assessment, the medical history questionnaire. (p 28)

13. The sedation practitioner should not proceed with sedation without having completed a detailed history in the form of an MHQ, followed by a focused and thorough clinical examination of the patient.
    a. True
    b. False

Insights into the clinical effectiveness of whitening products. (p 30)

14. The authors suggest that a shorter treatment period with a higher peroxide concentration (LED system), gives better results than a longer daily treatment with a low peroxide concentration.
    a. True
    b. False
15. Failure of anaesthesia with a mandibular block may be due to the presence of nerve fibres in accessory canals in the mandible.
   a. True
   b. False

The Research Focus Question. (p 36)

16. Identify the INCORRECT statement: Amongst the SIX questions posed by the authors are:
   a. Is it scientifically sound?
   b. Is it ethically justified?
   c. Is the method reliable and repeatable?
   d. Will it result in a patent?
   e. Is the procedure valid?

Maxillo-Facial Radiology Case 147 (p 35)

17. Canine fossa infections are normally caused by infections of a molar tooth.
   a. True
   b. False

18. Oral fistulas are very common.
   a. True
   b. False

Clinical Windows (p 41)

19. In the Ghaeminia et al. trial, factors such as gender, amount of debris at surgical site, age, etc., were significantly associated with inflammatory complications following mandibular third molar removal.
   a. True
   b. False

20. In the Shokraneh et al. trial, patients in the ProTaper group reported significantly lower postoperative pain levels at 6, 12, and 18 h compared with the patients in the two other groups.
   a. True
   b. False

ETHICAL

A patient suggests fraudulent behaviour. (p 40)

21. Ethical considerations are serious in circumstances where there are several treatment options, with the issue of Informed Consent being apposite.
   a. True
   b. False

22. Provided the patient makes the request it is not unethical for the practitioner to manipulate fees.
   a. True
   b. False

23. Probity implies honesty and is a critical Ethical principle.
   a. True
   b. False

24. Ethical principles in Dental Practice include beneficence, respect, integrity, truthfulness and placing the needs of patients first.
   a. True
   b. False

25. The principle of Informed Consent should ensure that all practical treatment alternatives, even if they are myriad in number, shall be placed before the patient.
   a. True
   b. False

Readers will note that we have reduced the number of General Questions to twenty whilst retaining five Ethics based questions. Our allocation of CPD points remains unchanged. There is optimism that this section will continue to provide members with a valuable source of CPD points whilst also achieving the objective of CPD, to assure Continuing Education. Please note that SADA is no longer offering the ‘CPD via SMS’ service.

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