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Fountain of Life

Visitors to fountains throughout the world have traditionally thrown a few coins into the waters and made a wish. If granted, it would benefit them personally. A noble twist to this concept is the fountain at Irene Dairy Farm in Pretoria. The wishing-coins are collected at the end of every day and donated to the Tshwane SPCA. This is a lovely way of "Making your Dreams Matter" and "Paying it forwards" at the same time. Visit Irene Farm - and we hope all your wishes come true!

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Our Front Cover for this Issue...

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Skills development gatekeeping. *Who gets to decide?*

SADJ August 2022, Vol. 77 No. 7 p383

Prof NH Wood - *MDent, PhD*

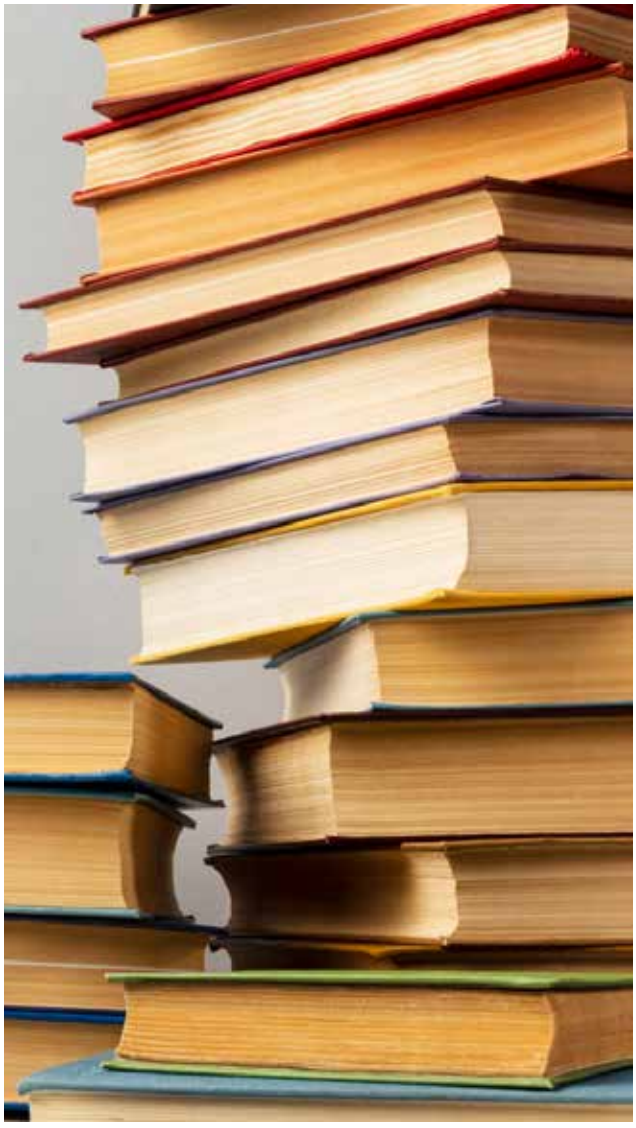
As the knowledge frontier advances, we find the development of new techniques and skills in the various disciplines of Dentistry. This has historically led to the establishment of highly focused or specialized fields of practice in which a particular practitioner develops and perfects specific competencies and skill sets. In turn the rapid advancement and development of these fields required legislated management, to ensure that the patient and community are protected from any unpleasant activities.

However, with the evolution of clinical dental practice and the rapid knowledge and technological advancement, a question is being raised: Who is in control of deciding when, how and where theoretic knowledge and clinical skills and competencies are disseminated? Although one may argue that knowledge is freely available for all practitioners to consume and to integrate into their daily practice, it would be facetious to leave out the fact that much of the integration requires clinical competency training that must be solidified through practice and repetition to become an expert. But why is this not accessible to all?

The modern digital age, and the ease of access to vast repositories of information is leaning towards the inevitable scrutiny and implementation of several diagnostic and treatment modalities in private practices, previously reserved for pre-defined categories of practitioners. Considering this, a position is often presented in which expertly skilled or specialist practitioners may well prefer to train those who are interested to practice skills in a particular field themselves. A reason for this is often that the teaching and training will be done inevitably, and that it should best be done by experts in that niche, rather than leave it to materials or product development companies as an example. Others will feel 'cheated' by giving younger or newer practioners the additional advantages of knowledge and skills they themselves had to develop over a number of years.

Gatekeeping of knowledge is a subject often discussed in other areas of academic and private sector teaching and learning. It has not yet been explored in Dentistry. As it stands, universities are generally considered the universal gatekeepers of this knowledge as the individuals within these institutions dictate the how, what, and when of knowledge distribution. Many may view gatekeeping as a logical instinct, however gatekeeping has a darker and more oppressive side to it. Acting as knowledge gatekeepers can be viewed as a disloyalty to intellectual curiosity, and disrespecting any new concept of accessible knowledge, technological disruption, and simply put: the democratic nature of data and empirical evidence. But again, who gets to decide and why. The 'how' aspect of knowledge dissemination, integration and implementation as competency skills is a whole new exploration once this uncomfortable topic has been discussed.

Indeed, I present many open-ended questions in the hope that these will stimulate productive academic discussions with the intention to further support and develop dentistry as it benefits from all the interest and eagerness of so many of our colleagues to excel in their chosen fields of expertise. I look forward to seeing these discussions grow and develop.



A Whole New World: Congress 2022

SADJ August 2022, Vol. 77 No. 7 p384

Dr Nthabiseng Metsing, Head: Professional Development, SADA

Following a successful 2021 virtual congress, the association hosted the 2022 SADA Dental & Oral Health Virtual Congress and Exhibition in hybrid format from 26th-28th August 2022 under the theme "A Whole New World". The physical congress was hosted at Emperors Palace in Kempton Park, Johannesburg with virtual sessions streamed daily for virtual attendees.

Even though the 2021 congress was completely virtual, 2022 brought another dawning of innovation when SADA ventured into the hybrid arena, and we were extremely enthusiastic about the Congress. SADA strongly encouraged oral health care professionals to be part of history and urged to them to attend the event after a long period of no physical engagements brought about by the advent of the Covid-19 pandemic.

The SADA Scientific Committee worked tirelessly behind the scenes to put together a program with rich mixture of local and international speakers who addressed topics that bear relevance to state of clinical practice. The entire Congress team worked tremendously hard to put together an all-inclusive program, that ran from Friday to Sunday, accommodating practitioners of all ages including current oral health care professional students, 2022 graduands, to the most experienced clinicians with the option of being there physically or virtually. SADA catered for anyone involved or with an interest in oral health care, and the team put in an abundance of effort to ensure that the oral health team in its entirety was encompassed in the offerings. This was addressed by having sessions that were relevant to specialists, general practitioners, dental therapists, oral hygienists through the different lectures.

The team joined hands with dental and non-dental traders who all played a robust role in ensuring that the congress came to fruition. Thank you to the traders who sponsored master classes that were available providing attendees with a practical perspective of what the presenters were teaching and the delegates could get a look and feel of the desired outcomes.

Thank you to all our Exhibitors and Sponsors:

- Titanium Registration Partner - Glaxo Smith Kline - Sensodyne
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- Gold - Colgate-Palmolive (Pty) Ltd, GEMS, Novodent SA
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SciVision, Sikelela Medical & Dntal, Solumed, South African Association of Paediatric Dentistry, Southern Implants, Trojan Medical (Pty) Ltd, Waterpok Africa, Wright-Millners Dental, Zoom Whitening, Zumax/Equiy Dwental (Pty) Ltd

- Foyer - Adin Dental Implants, Africa X-Ray Industrial & Medical, D Cubed Digital, Dental Mech, Gendent, International Team for Implantology, Istrodent (Pty) Ltd, Medequip Rental, Medi Coop, Nedbank, Orthosense, Strauumann Group, Summit Asset Management, Tasosol
- German Pavilion

Thank you to Henry Schein Dental Warehouse and Dentsply Sirona for their participation in the Master Classes offered on Friday 26 August.
The congress organising team planned and achieve the following:

- 310 online delegates.
- 371 Physical delegates
- The trade Exhibition comprised of a total of 80 stands inside 14 of which were the from the German Pavilion. 14 Stands exhibited in the Foyer and there was also 1 car exhibition. In total we had 53 South African Dental trade companies participating in this year's congress.
- 11 International and 42 Locally based Speakers.
- 2 Master Class Sessions.
- Parallel Programmes that accommodated all members of the oral health profession.

The congress had something for everyone within Dentistry from Dental Assistants to Specialists with some of the offerings being livestreamed for the virtual attendees.

Friday 26 August the days very busy proceedings closed with a cocktail occasion to officially welcome the delegates and traders. Saturday 27 August lunched in great style with the grand opening ceremony at which nominated awards recipients received their awards as deserving members who had been nominated through their branches and colleagues.

Congratulations to Dr Mark Bowes who received SADA's highest honour – The SADA Premier Award.

We also take this opportunity to again congratulate the 2021 University students' top achievers from the four Dental Schools.

Saturday evening concluded with a night of bliss for the 2022 final year students at their Graduands Gala. This was a private gala event and well attended by the SMU, Wits and UP students, as we introduced them to SADA and their new and not-so-new colleagues. SADA wishes them well on their journey as they step into their Community Service year. Congress closed on Sunday 28 August with SADA Chief Executive Officer, Mr KC Makhubele addressing delegates and traders, and extending gratitude to all concerned for another successful Congress. Mr Makhubele called on all to save the day now for the 2023 Congress which will be taking place at CTICC, Cape Town from 25 – 27 August 2023. Details of this event will be made public as soon as information is available. Keep watching www.sadacongress.co.za for news.

As per requirement the congress was also accredited in accordance with the HPCSA guidelines and the following approval has been received. Depending on the streams' chosen delegates were eligible to a total of 18 points for the congress. 18 Clinical points and 6 Ethical. A total of 18 points can be earned during the congress, depending the stream you followed.

Physical
Friday: 6 Clinical CEU's and/or 3 Ethical CEU's
Saturday: 7 Clinical CEU's and/or 2 Ethical CEU's
Sunday: 4 Clinical and/or 1 Ethical CEU's
Virtual
Friday: 6 Clinical CEU's
Saturday: 7 Clinical CEU's
Sunday: 4 Clinical and/or 1 Ethical CEU's

We believe that this congress has assisted delegates with their continuous professional development requirements as indicated by the HPCSA and hope that delegates had fun and enjoyed the weekend while achieving additional learning. The responsibility of ensuring that members are compliant is one that SADA takes very seriously, it has an added impact on the quality of oral health care that our members provide to their patients.

SADA worked with Creative Space Media (Pty) Ltd (CSM) who are specialists in the management, publishing, broadcasting and advertising of the 2022 SADA Dental & Oral Health Virtual Congress and Exhibition. SADA first engaged with CSM in 2021 to manage the 2021 virtual event. CSM facilitate strategic product and property sales through product development, content strategy and development. CSM have high level relationship and business development with key clients and stakeholders, and SADA hopes to engage with them in 2023.

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Stressors in Dental Students During the Transition from Theory to Practice: *A Qualitative Research*

SADJ August 2022, Vol. 77 No. 7 386-393

MA Hashemipour[1], V Hosseini[2], H Kamyabi[3]

ABSTRACT

Introduction
Dentistry is one of the most challenging, demanding, and stressful fields of study. Dental students are expected to acquire various skills, including academic, clinical, and interpersonal skills. This study aimed to investigate the stressors in students during the transition from theory to practice through qualitative research methods and ultimately improve curricula used for learning.

Methods
This cross-sectional study was performed on fourth to sixth year students of Kerman Dental School through interviews. Interviews related to the experienced clinical stress and challenges and experiences in the clinical environment were conducted with 40 students (16 males and 24 females) who were randomly included in the study and the participants' statements were recorded with their consent. The interview continued until the stage of information saturation and at the end it was confirmed by the participants in the study. Qualitative data were analyzed based on content analysis and then the data were classified.

Results
In this study, 8 people were in the fourth year, 16 people were in the fifth year and 16 people were in the sixth year. According to the statements and experiences of students, stressors such as reprimand and lack of time were the most common causes of clinical stress. Other factors, such as professors' attitudes and infection control, also had a significant effect on stress. Patient-related factors such as not having a patient, their late or late arrival, and being harassed at work were also cited as causes of stress.

Conclusion
Many factors in the clinical environment play a role in the stress of dental students, which can be eliminated or reduced to greatly contribute to the quality of education. According to the results of this study and the recognition of stressors in the clinical environment, more attention of the authorities to this field and the need to review clinical education seems necessary.

Keywords: Stress, Students, Qualitative, Research, Interview

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3.	Homa Kamyabi:	33.3%

INTRODUCTION
The word stress, widely used today, was first defined in 1963 by Hans Selye[1]. Essentially, stress is the body's response to any perceived demand, change, or threat, and the stressor is a situation or event that triggers that response [2-4]. Stress can also have a positive effect and provoke the person or have a negative effect and produce a feeling of being threatened [5].

Today, it is known that stress or tension is the primary factor affecting mental health [6-8]. Among different groups of society, students experience high stress due to factors such as distance from the family, entering large and stressful groups, economic problems, low income, a large number of courses, and intense competition [8].

Dentistry is one of the most challenging, demanding, and stressful fields of study. Dental students are expected to acquire various skills, including academic, clinical, and interpersonal skills [9,10]. In recent decades, several studies have examined the sources of stress for dental students in different educational environments. Several factors that cause stress include workload, academic factors, clinical education, anxious patients, complex treatments, dealing with patients, and limited time to complete treatment [11,12]. Thus, it can be argued that some stresses are inherent in medical and dental education and cannot be eliminated [13].

Also, due to the close relationship between the dentist and the patient, the dentist considers himself responsible in terms of professional ethics, and the slightest unintentional mistake puts him under stress both emotionally and legally [13,14]. In addition, the recognition of the transition from the theoretical to

the clinical state has been reported in psychological education as a dynamic emotional and social process. Thus, although this transition to clinical education might be a specific period for personal and professional development, it might also be a source of stress and anxiety [14].

In general, if persistent, stresses will have harmful consequences such as physical, psychological, and emotional effects, causing psychological complications, including depression, obsession, personality disorders, and feelings of inefficiency, anxiety, resentment, and boredom. In addition, stress-induced impatience might even lead to a lack of interest in the field of study [12-14].

If stresses are not dealt with effectively, they can lead to psychological and physical symptoms and endanger health, with significant detrimental effects on individuals' health and efficiency. The most harmful effect of stress is disruption and impairment of effective performance, thinking power, and learning. In addition to the above consequences, students might show maladaptive habits and responses in the face of stress, such as smoking, alcohol abuse, medications, drug abuse, or suicide attempts [12-14].

There are limited studies on transitional stress in dental students; however, significant stress and anxiety levels have been reported during their training period. In previous studies, the emphasis has been on the educational environment, and factors such as the influence of professors, communication with classmates, and communication with professors have not been considered [14-18].

This study aimed to investigate the stressors in students during the transition from theory to practice through qualitative research methods and ultimately improve curricula used for learning.

METHODS

Also, before starting work, this dissertation was approved in the Ethics Committee of university with the code of ethics IR.KMU.REC.1398.478. The samples included all the fourth- to sixth-year dental students of Kerman Dental School. In this comprehensive functional study, in-depth group and individual interviews were conducted with several students. Students from the fourth, fifth, and sixth year were present in each group to homogenize the groups. Before the interview, oral consent was obtained from the students for their who inclusion in the research.

Forty students participated in this study 4 groups of 10, determined by information saturation. Twenty-four students were female, and sixteen were male. The participants were selected by contacting class representatives or talking to the individuals themselves. Aspects discussed in these questions include the student's readiness to enter clinics, their experience with patients and their management, any specific problems encountered in clinical sessions, and challenges related to going to the clinic. There were no right or wrong answers, and what the students shared did not affect their grades in any way, and students were assured that all comments collected would be kept confidential and anonymous.

For a better interview, individuals were given the opportunity to express their views in full, and their experiences and attitudes were assessed. A trained researcher (a last-year student in the field of qualitative data collection (AC) conducted semi-structured interviews with participants. With the permission of the focus group participants, all audio conversations were recorded and no notes were taken during the interview, which in turn led to more focus on the participants' speech.

A pre-project interview guide was designed. In this guide, scientific literature extracted from other researches and clinical experiences of the interview team were used. However, the timing and schedule were not exactly the same for the participants because each participant had different behavioral ethics. For example, some spoke in such a way that there was no need to ask further questions during the interview, while some other participants spoke in such a way that the interviewer was forced to ask more questions. The interview was conducted very simply to allow participants to present their views and talk in more detail.

Data collection, copying, and data analysis were performed simultaneously to enable the design of a new topic and determine the achievement of existing theoretical saturation. Theoretical saturation was defined as information saturation, and the point of theoretical saturation is reached when no more interviews are added to the information required for a particular topic. The interview process was stopped when the researchers found that enough information was available to analyze and obtain students' views and beliefs.

A last-year dental student conducted the interviews. The text of the interviews was recorded as a tape. Then the subjects' opinions were immediately reviewed and coded separately by the two researchers immediately after the first interview and continued until the stage of data saturation. In addition, to increase the scientific accuracy of the study and determine its validity, the codes taken from each interview were again given to the participants to ensure researchers' perceptions of their opinions. Finally, data were analyzed based on content analysis, and the analyzed data were classified, and the number of respondents for each category was determined.

RESULTS

In this study, in-depth interviews were conducted with 40 students. There were 16 males (40%) and 24 females (60%). Eight were in the fourth year (20%), 16 (40%) were in the fifth year, and the rest were in the sixth year (40%). Table 1 presents the demographic characteristics of the participants in the study.

After encoding the data, the codes were classified. The codes related to the students, along with the number of responding groups related to each code, were as follows:

Table 1. Demographic characteristics of the participant

Semester	Sex	Age	No	Semester	Sex	Age	No
9	Female	23	21	7	Male	21	1
9	Female	23	22	7	Male	22	2
9	Female	22	23	7	Female	22	3
9	Female	22	24	7	Female	23	4
11	Male	23	25	7	Female	21	5
11	Male	23	26	7	Female	22	6
11	Male	24	27	7	Female	22	7
11	Male	24	28	7	Female	22	8
11	Male	23	29	9	Male	22	9
11	Male	25	30	9	Male	23	10
11	Male	23	31	9	Male	23	11
11	Female	23	32	9	Male	23	12
11	Female	24	33	9	Male	23	13
11	Female	32	34	9	Male	24	14
11	Female	24	35	9	Male	22	15
11	Female	26	36	9	Male	22	16
11	Female	28	37	9	Female	22	17
11	Female	24	38	9	Female	23	18
11	Female	24	39	9	Female	24	19
11	Female	25	40	9	Female	24	20

- Stress on the first day in a faculty department [4]
- Stress in dealing with professors [5]
- Stress due to doing the wrong thing [3]
- Stress due to non-compliance with infection control [5]
- Stress of not having a patient in different departments [4]
- Stress of lack of time [6]
- Stress of being reprimanded [6]
- Stress of the lack of equipment [4]
- Stress of patient harassment during treatment [4]
- Stress of injury by needle stick [4]

To better understand the issues and clarify stress types, the cases were divided into stresses related to patients and lack of education, stresses related to clinical treatment, and stresses related to professors.

Stresses related to unfamiliar clinical treatments or lack of education

- As students entered some departments, they reported information gaps related to unfamiliar clinical treatments or lack of education.
- Unawareness of how to deal with the patient
- Being unfamiliar with the principles of infection control
- Lack of education about the rules of the department or obtaining the necessary information in each department.

Students' remarks

- I did not know what I should have known, and I did not know the right thing to do. When we go to the clinic, we still do not know anything about radiography.
- When I do something for the patient for the first time, I do not know whether it has a good result or not! Each department is different in terms of infection control and work routines, which is also true for professors because each professor has their own system and expects the student to follow that system.

Stresses related to clinical treatments and departments

The stress of doing the wrong thing leads to a confrontation with professors.

Students' remarks

- In the surgical department, if we break a root or the residual root is left in place, we will be reprimanded, and it might even lead to the lesson being dropped.
- In the endodontics department, overfilling or having voids in the obturation, using a single gutta-percha cone, breaking a file inside the root canal, or perforating a root canal are considered disasters.
- If we do something wrong in some departments, they will impose heavy fines on us, unlike other universities that do not impose these fines.
- Early on, I was afraid of not achieving anesthesia. It is always stressful for me when my patient gets worse, and I cannot control the situation.
- It is stressful every time I face a new situation, and I do not know how to treat the patient. If I do something for the patient that eventually fails, it puts a lot of stress on me.
- In the endodontic department, we have the stress of accessing, and in the filing stage, the stress is that the root canal is calcified.
- The restorative department also has the most significant concern about reaching the pulp. The main problem is an incorrect injection technique because we have not given many injections.

Stresses related to not being enough patients or specializing in patients' treatment

Students' remarks

- It is difficult to find patients whose treatment can be managed by undergraduate students in the orthodontics department. Also, because of the long waiting period, sometimes, patients refer to private offices and clinics and do not wait for their turn.
- In some departments, such as endodontic and prosthetics, it is difficult to find a patient, and even after finding the patient, he/she might be specialized, which wastes a lot of time and causes a lot of stress.
- For me, the biggest stress has always been finding a patient, especially in endodontics, or if, for example, the course lasts a week, when we find a patient in the last days, we have to carry out the procedure quickly because adding extra days leads to trouble.

Stresses related to lack of time

Students' remarks

- Working in the department is very different from working in the phantom clinic, and in departments such as endodontics and prosthodontics, we are always worried about time pressures.
- In some departments, such as endodontics, students in the last rotation of the semester might not be able to fulfill their requirements.
- If we have a complicated procedure, we have to spend a lot of time on it, which might lead to an unfinished or even dropped score.

Stresses related to equipment and materials

Students' remarks

- The material room of departments, especially the complete denture section and endodontic, is very annoying. They do not deliver the items on time, or they constantly complain.
- Equipment is not adequate; for example, most of the handpieces in the endodontics department are broken, and when we protest, they tell us to bring our own equipment.
- Sometimes the equipment is not clean, and we are worried that it will harm the patient and us.
- Some units in each section are damaged, making it impossible to carry out the procedure. In
- addition, we might have to spend a lot of time repairing the unit, leading to unfinished treatment, which often happens in the endodontics and restorative departments.
- I am always afraid that I might not have fully prepared the equipment, and I have forgotten something in the set or have not sterilized my equipment.
- One of my biggest stresses, especially in endodontic and restorative procedures, is finding an empty unit. It is a problem to find a unit for the patient.
- Damaged handpieces or limited equipment such as apex locators are a problem; I have to wait for others to finish using them.

Stresses related to professors

Students' remarks

- Behavior of Oral Medicine Professors Because I have heard that the professors of this department behave seriously.
- The main problem is the professors who arrive late, especially in the prosthetics department, which causes patient complaints and delays in the treatment process.
- Another problem is the different opinions of endodontic professors; the procedure is carried out in several stages with several professors, and none of them accepts the other's opinion.
- The stress in the pediatric department is due to children's behavior and their fear of a particular professor. Some professors do not start the class on time or finish it on time, making it impossible for us to be present in the oral disease department on time.
- Sometimes we have to wait for a long time for our professors in the clinic. Naturally, this complicates the treatment process, and the patient has to wait for a long time, making them angry.
- Professors' personal animosities that cause additional stress.
- Most professors think that students know everything perfectly and expect the best from us.
- In some departments, any wrongdoing will eventually lead to receiving a severe reprimand.
- I have always been confident in my work since I entered the clinical course. The only fear I had was the fear from the professor because sometimes the professor causes stress with a series of inappropriate attitudes. For example, in the restorative department, the professor asked me to remove caries, and when I removed it, the professor said, "Why did you remove it so much?" And when I told him that I did what you said, he did not believe or reacted as if he did not believe me. I was worried that I might not pass this course. This means that the professors do not trust the students. Of course, they are right in some cases because some students do not care about the patient, but the patient is important to me personally. Unfortunately, no matter how respectful I am to the professors, they still show a certain attitude.
- This is the case only in our school: education is insufficient, and the student himself must how to treat the patient by trial and error. Another reason is that the professors are not effectively present in the department, and no one supervises the student.
- The concern was to get signatures and approvals. I was doing the treatment, but because the professor left the department sooner, I could not get the signature, and the next session I had to show the whole thing so that I could remind the professor. The next point is that some professors did not trust at all, and some of them trusted so much that they left the patient to our care and did not supervise at all.

Patient-related stress

Students' remarks

- The patient does not arrive on time or refuses to continue treatment after completing some steps.
- Patients expect treatment to be done in one session, or to take less cost, and we will have to tolerate for fear of losing the patient, or we will have to pay part or all of the expenses that the patient has to pay.
- Patients ask why their prosthetic treatment is not finished; they hope to treat many teeth in a single session and minimize the number of visits.
- Sometimes the patient is bothered or experiences

severe pain during treatment, but we are not allowed to re-anesthetize.
- Some patients do not pay for their treatment and leave the faculty, which causes us to pay for it ourselves.
- The patient gets tired during treatment, which increases the number of treatment sessions.
- When we ask the patient to do a laboratory test, he or she often refuses it.

DISCUSSION

This study investigated the stresses of attending clinical departments in Kerman dental students through interviews. The results of this study showed that the most common factors that caused stress in students. These factors include the first day of entering the department, the professors' behavior, doing the wrong thing, lack of infection control, a lack of patients in different departments, lack of time, being reprimanded, lack of equipment, harassing the patient during treatment, and needle stick injuries.

Studies show that studying dentistry can be very stressful [11-14]. It can be argued that some stresses are part of the nature of medical and dental education and cannot be eliminated [19-23].

However, recent studies have shown that dental students experience much higher stress levels than medical students [24,25].

Studies show that the most stressors are exams and grades, clinical procedures and patient management, completing clinical assignments, student-professor interactions (how teachers treat students such as cold behavior, insignificance, lack of encouragement), discrimination between male and female students, criticism, and excessive expectations from students), student relations with staff and other students, meeting the expectations of family and friends, responsibility for treating patients, managing non-cooperative patients, fear of contracting infectious diseases in the department, a lot of patients to treat and lack of free time [21-24, 2-4].

A study on dental students in Babol [26] showed that dental students experienced moderate stress, consistent with a study by Dalband and Farhadinasab in the School of Dentistry, Hamadan University of Medical Sciences [19]. Naidu et al. (2002) [27] and Morse et al. (2007) [28] reported that the overall average stress experienced by dental students was moderate. Such similarities in the results are probably related to the dental curricula and the similar educational system in this university with the mentioned universities.

The present study showed that the most stressful department were endodontics, oral diseases, and surgery, and the least stress was related to the periodontics department. Even in the statements of some students, the periodontics department was mentioned as stress-free. It is noteworthy that the mistakes and behavior of the professors caused stress in the students.

In a 2009 study of 307 dental students at two dental schools in Jordan, Badran et al reported that surgery and endodontics departments had the highest stress levels [29]. After the study, the officials asked the two mentioned department to make changes in their educational system. It should be noted that their results in high-stress conditions were related to the endodontics department similar to ours, which indicated the high level of stress for dental students in this department, regardless of the university. This might be due to the high level of difficulty in endodontic procedures due to the indirect vision, poor patient cooperation, etc.

Argypolychronopoulou and Divaris (2005) assessed and compared stress levels in 337 dental students and reported that they all complained of a lack of enough time for exercise and rest [30]. In a 2009 study, Kumar et al. reported that the main stressors were workload and the large volume of study content [31].

Polychronopoulou and Divaris, in a 2005 study in Greece, reported "test scores" and "inability to fulfill the requirement" as the main stressors [30].

A study examining the stress of dental students at the University of Jordan reported that the most common stressors were a lack of time and patients' late arrival or failure to arrive for their appointments. Comparison with previous studies also showed that Jordanian dental students perceived stress more than other students for matters related to the educational environment and personal or cultural aspects [32].

Research at the University of Manchester on dental students also showed that the highest-scoring factors varied throughout the course. However, exams, fear of failure in the course or year, shorter and fewer vacations than other university students, and the quantity and variety of work in a limited time were the most common [33].

A study of dental students at the University of Greece found that the amount of work in the classroom (82%), exams and grades (76%), lack of self-confidence to become a dentist, completion of graduation requirements (68%), deficiency in dedicated time to school (64%), and lack of time to rest (64%) were the most common causes of stress [30].

The most important stressors in Nigeria were the lack of a good education system and dental support in terms of the availability of materials for clinical education and study materials [34].

In India, most cases of stress were in fourth-year students, except treating patients with dirty mouths which showed higher levels of stress in the third year, because education on real patients actually begins that year [35].
Some stressors among South African dental students included the educational environment, fear of failure, heavy workload, problems dealing with patients, curricula, and challenging relationships with university staff [36].

In Malaysia, the lack of cooperation between professors and patients caused stress in students. In addition, students were concerned about inconsistent feedback from their professors [37].

In a study in Mashhad, seven factors had a significantly higher mean score in students with abnormal stress levels than students with normal stress levels. These factors include fear of failure to complete the requirement on time, the high workload in the faculty and lack of free time, discrimination between students by professors, inadequate educational planning and unit selection, discrepancies in the training of different professors of a department, dissatisfaction with the evaluation of clinical performance by professors and failure to meet the needs of students by officials [38].

Dental education is a challenging learning experience. As a dentist, students are expected to learn the theoretical and practical aspects of the dental curriculum in addition to dealing with patients. It has also been reported that dental students experience a higher level of stress than medical students, which is justified by the additional psychological skills required in dentistry [24].

The results of a study on students in Shiraz [39] showed that students experience normal stress levels. However, a previous study showed that dental students experienced moderate stress in the educational environment, indicating a stressful education environment in the dental school 38. In addition, the levels of depression, anxiety, and stress of students in this study were approximately half those of students in a previous study [40].

Other issues that caused stress in students in this study were professors' attitudes and sometimes discriminatory attitudes. In a study in Shiraz [39], researchers showed that the atmosphere created by professors in the clinical environment and the criticism that students received from faculty members in the presence of the patient were the factors that played an important role in creating stress for dental students.

In this study, exams were not mentioned as stressors, unlike other studies [41-46,27,23,20,35,32, 33,30]

Lack of clinical time, completion of clinical requirements, problems in managing difficult cases, and disagreements between professors about clinical treatments were other major causes of stress. According to Kumar et al. [47] and Asharia [35], the "requirement system" in education has been identified as a stressor in Indian studies. If the emphasis is shifted from the number of completed cases to the quality of completed cases, it can reduce stress in students. In addition, the skills needed to manage a patient should be part of the curriculum. This increases students' self-confidence and self-efficacy beliefs in dealing with patients [34].
Stressors are mainly related to the nature of education, and we are faced with the side effects of high stress on students' health and well-being [48]. A study by Hawazin et al showed that lack of clinically allocated time, lack of time to rest and reduced vacations, full working day, receiving criticism from supervisors about academic or clinical work, the degree of fraud in the dental school, the rules and regulations of the school, and the fear of unemployment after graduation are also mentioned as frequent stressors [49].

In a similar study that assessed dental stressors in students at the University of Manchester, Heath et al. 33 found that potential stressors included (1) information overload (2), fear of incompleteness and diversity of work, (3) inadequate and contradictory feedback on performance (4), and proximity to faculty and staff.

George et al [50] showed a relationship between the personalities of dental students and stress levels. A study on Australian dental students showed that stress is due to a tendency towards perfectionism, based on a history of high progress and strong educational expectations [50]. According to Dodge et al. [51], students report significantly less stress when clinical training and evaluation are not based on the requirement. According to a study by Schwartz et al. [52], the establishment of student counselors and counselors in a dental school with a student-centered counseling system and knowledge-based programs promotes an advanced learning environment. Hence, a stress reduction program should be implemented with particular attention to women.

It seems that modifying the curriculum and environment, as well as adopting stress management strategies and providing resources, will help reduce stress in dental education and students' success.

However, some stressors seem to be inherent in vocational training and have a wide range of dental implications. Therefore, a modern dental school must effectively manage potential sources of stress to promote the educational and professional health of its graduates. Identified factors should be considered in combination with stress management measures to reduce the chances of mental fatigue and improve students in a healthy and stress-free environment. Modifications in curriculum and teaching methods, emphasis on active quality learning, modular teaching, descriptive assessment not just summary assessment, and reducing the focus on requirements have been suggested by academics as a way to reduce stress.

CONCLUSION

Many factors in the clinical environment play a role in the stress of dental students, which can be eliminated or reduced to contribute significantly to the quality of education. However, according to the results of this study and the recognition of stressors in the clinical environment, authorities should pay more attention to this field and review clinical education.

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Conflict of Interests

Authors have no conflict of interest.

REFERENCES

1. Selye H. Stress and psychiatry. Am J Psychiatry 1956; 113: 423-427.
2. Sayedmoallemi Z, Naseri F. Assessment of the perceived stress due to different educational factors among senior dental students of Medical Sciences Universities in Iran. J Isfahan Dent 2014; 9(6): 498-508.
3. Esfahanizadeh K, Ziaii SH, Mirsharif Z, Nasri S, Mirsharif F, Valaii N, Sadra E. Changes in mental health status and sources of stress in dental students of Islamic Azad University, Tehran. Pejouhandeh 2013; 18 (1):34-9.
4. Kazemizadeh Z, Bakhshi H. Dental Environment Stress and Students' Personality in Rafsanjan Dentistry School. Iranian J Med Edu 2011; 11 (5): 467-477.
5. Pop-Jordanova N, Radojkova-Nikolovska V, Markovska-Simoska S. Perceived stress in dental practice. Prilozi 2013; 34 (2):135-41.
6. Ross SE, Niebling BC, Heckert TM. Sources of stress among college students. College Student J 1999; 33 (2):312-8.
7. Shariati M, Kaffashi A, Ghaleh Bandy MF, Fateh A, Ebadi M. Mental health in medical students of the Iran University of Medical Sciences. Payesh Health Monit 2002; 1(3): 29-37.
8. Lloyd C, Musser LA. Psychiatric symptoms in dental students. J Nerv Ment Dis 1989;177:61-9.
9. Schmitter M, Liedl M, Beck J, Rammelsberg P. Chronic stress in medical and dental education. Med Teacher 2008; 30 (1): 97-9.
10. O'Mahony P, O'Brien S. Demographic and social characteristics of university students attending a psychiatrist. Br J Psychiatry 1980; 137: 547-50.
11. Divaris K, Barlow PJ, Chendea SA, Cheong WS, Dounis A, Dragan IF, et al. The academic environment: The students' perspective. Eur J Dent Educ 2008; 12:120-30.
12. Montero-Marin J, PivaDemarzo MM, Pereira JP, Olea M, Garcí´a-Campayo J. Reassessment of the psychometric characteristics and factor structure of the perceived stress questionnaire' (PSQ): analysis in a sample of dental students. PLoS One 2014; 9 (1): e87071.
13. Nafarzadeh SH, HajiAhmad M, Moudi S, Mosaferi. Evaluation of stress level and its related factors in dentistry students of Babol University of medical sciences in academic year of 2013-2014. J Babol Univ Med Sci; 2014; 48-53.
14. Mehdizadeh M, Kheirkhah F, Vojdani Fakhr H, Noori Bayat SH. Stress factors in dental students of Babol university. J Dent Sch 2014; 32 (3): 151-158.
15. Frese C, Wolff D, Saure D, Staehle HJ, Schulte A. Psychosocial impact, perceived stress and learning effect in undergraduate dental students during transition from pre-clinical to clinical education. Eur J Dent Educ. 2018; 22(3): e555-e563.
16. Nguyen TTT, Seki N, Morio I. Stress predictors in two Asian dental schools with An integrated curriculum and traditional curriculum. Eur J Dent Educ. 2018; 22: e594- e601.
17. Seijo MO1, Ferreira EF, Ribeiro Sobrinho AP, Paiva SM, Martins RC.Learning experience in endodontics: Brazilian students' perceptions. J Dent Educ. 2013; 77(5):648-55.
18. Himida T1, Nanjappa S1, Yuan S1, Freeman R. Dental students' perceptions of learning communication skills in a forum theatre-style teaching session on breaking bad news. Eur J Dent Educ. 2019; 23(2):95-100.
19. Dalband M, Farhadi Nasab A. Evaluation of stress-inducing factors of educational environment in Hamadan dentistry school's students. Sci J Hamadan Univ Med Sci 2007; 13(4):48-52.
20. Garbee WH Jr, Zucker SB, Selby GR. Perceived sources of stress among dental students. J Am Dent Assoc 1980; 100 (6): 853-7.
21. Westerman GH, Grandy TG, Ocanto RA, Erskine CG. Perceived sources of stress in the dental school environment. J Dent Educ 1993; 57 (3): 225-31.
22. Cecchini JJ, Friedman V. First year dental students: Relationship between stress and performance. Int J Psychosom1987; 34 (3): 17-9.
23. Wilson RF, Coward PY, Capewell J, Laidler TL, Rigby AC, Shaw TJ. Perceived sources of occupational stress in general dental practitioners. British Dent J 1998; 184 (10): 499-502.
24. Murphy RJ, Gray SA, Sterling G, Reeves K, DuCette J. A comparative study of professional student stress. J Dent Educ 2009; 73 (3):328–37.
25. Birks Y, McKendree J, Watt I. Emotional intelligence and perceived stress in healthcare students: a multi-institutional, multi-professional survey. BMC Med Educ 2009; 9:61.
26. Silverstein S, Kritz-Silverstein D. A longitudinal study of stress in first-year dental students. JDent Educ 2010; 74: 836-848.
27. Naidu RS, Adams JS, Simeon D, Persad S. Sources of stress and psychological disturbanceamong dental students in the West Indies. J Dent Educ 2002; 66:1021-1030.
28. Morse Z, Dravo U. Stress levels of dental students at the Fiji School of Medicine. Eur J DentEduc 2007; 11: 99-103.
29. Badran D, Duaibis R, Al-Ali M, Oweis T, Amin W. Health status of the clinical dental students inthe Jordanian universities. J Clin Med Res 2009; 1: 45-49.
30. Polychronopoulou A, Divaris K. Perceived sources of stress among Greek dental students. Journal of dental education. 2005; 69(6):687-92.
31. Kumar S, Dagli RJ, Mathur A, Jain M, Prabu D, and Kulkarni S. Perceived sources of stress amongstIndian dental students. Eur J Dent Educ 2009; 13: 39-45
32. Rajab L. Perceived sources of stress among dental students at the University of Jordan. Journal of dental education. 2001; 65(3):232-41.
33. Heath J, Macfarlane T, Umar M. Perceived sources of stress in dental students. Dental update. 1999; 26(3):94-100.
34. Sofola O, Jeboda S. Perceived sources of stress in Nigerian dental students. European journal of dental education. 2006; 10(1):20-3.
35. Acharya S. Factors affecting stress among Indian dental students. Journal of dental education. 2003; 67(10):1140-8.
36. Wilson V, Rayner C, Gordon N, Shaikh A, Crombie

K, Yasin-Harnekar S. Perceived stress among dental students at the University of the Western Cape. South African Dent J. 2015; 70(6):255-9.
37. Babar MG, Hasan SS, Ooi YJ, Ahmed SI, Wong PS, Ahmad SF, et al. Perceived sources of stress among Malaysian dental students. Inter J Med Educ 2015; 6:56.
38. Akbari M, Nejat A, Dastorani S, Rouhani A. Evaluation of stress level and related factors among students of Mashhad Dental School (Iran) in academic year of 2008-2009. J Mashhad Dent School. 2011; 35(3):165-76
39. Jowkar Z, Masoumi M, Mahmoodian H. Psychological Stress and Stressors among Clinical Dental Students at Shiraz School of Dentistry, Iran. Adv Med Educ Pract. 2020; 11: 113–120.
40. Aboalshamat K, Hou X-Y, Strodl E. Psychological well-being status among medical and dental students in Makkah, Saudi Arabia: a cross-sectional study. Med Teach. 2015; 37(sup1):S75–S81.
41. Hinshaw KJ, Richter LT, Kramer GA. Stress, Burnout, and Renewal Activities of Dental Hygiene Education Administrators in Six U.S. Midwestern States. J Dent Educ 2010; 74:235-50.
42. Humphris G, Blinkhorn A, Freeman R, Gorter R, Hoad-Reddick G, and Murtomaa H, et al. Psychological stress in undergraduate dental students: Baseline results from seven European dental schools. Eur J Dent Educ 2002; 6:22-9.
43. Sugiura G, Shinada K, Kawaguchi Y. Psychological well-being and perceptions of stress amongst Japanese dental students. Eur J Dent Educ 2005; 9:17-25.
44. Alzahem AM, van der Molen HT, Alaujan AH, Schmidt HG, Zamakhshary MH. Stress among dental students: A systematic review. Eur J Dent Educ 2011; 15:8-18.
45. Yap AU, Bhole S, Teo CS. A cross-cultural comparison of perceived sources of stress in the dental school environment. J Dent Educ 1996; 60:459-64.
46. Sanders A, Lushington K. Sources of stress for Australian dental students. J Dent Edu. 1999; 63(9):688-97.
47. R M Schwartz, C R Eigenbrode, O Cantor. A comprehensive stress-reduction program for dental students 1984; 48(4):203-7.
48. Cohen S, KamarckT. Mermelstein, R. A global measure of perceived stress. J Health Soc Behav1983; 24: 386-396.
49. Hawazin WE, Paul JA, Ritu AK, Mancini L, Lambru A, Bedos C. A Systematic Review of Stress in Dental Students. J Dent Educ 2013; 78: 226-242.
50. George JM, Whitworth DE, Sturdevant JR, Lundeen TF. Correlates of dental student stress 1987; 51(8):481-5.
51. Dodge WW, Dale RA, Hendricson WD. A preliminary study of the effect of eliminating requirements on clinical performance 1993; 57(9):667-72.

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Knowledge, attitudes and practices of emergency care practitioners in the management of common dental emergencies in the eThekwini District, KwaZulu-Natal.

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ABSTRACT

Introduction

It is essential to provide timeous and appropriate treatment in cases of dental emergencies. First responders such as Emergency Care Practitioners (ECPs) usually provide this prehospital care. The successful management of casualties experiencing common dental emergencies is dependent on two fundamental factors; the first responder's knowledge and ability to render the appropriate level and standard of medical care, and; secondly, the time that expires between the onset of the incident and the initiation of definitive emergency medical treatment. Delayed or inappropriate management can have long term physiological and psychological effects.

Objectives

This was an exploratory and descriptive study, using quantitative and qualitative methods to determine the knowledge and attitudes of Emergency Care Practitioners of the eThekwini District of KwaZulu-Natal, South Africa, in the management of dental emergencies.

Results

The results revealed that Emergency Care Practitioners had inadequate knowledge, training, and understanding of the management of common dental emeregncies by ECPs. There was limited initial training, with a significant portion of the participants (44.9%, p 0.233) having not received any training at all in the management of orofacial traumas, and with a significant majority (78.3%, < 0.001) having no further education and training. Most ECPs indicated a desire to receive such training.

Conclusion

This study indicated that ECPs lacked confidence in managing dental emergencies, which highlighted a need for specific dental awareness and training programs to further empower ECPs in the management of such emergencies.

Keywords: Common dental emergencies, Emergency Care Practitioners, Emergency Medical Management, Knowledge, attitudes and practices

INTRODUCTION

Dental emergencies are fast becoming an oral health issue due to its increased prevalence.[1] Dental emergencies, including dentoalveolar fractures, maxillary and mandibular fractures, and complications of untreated tooth infections require immediate management.[1] Any delay or improper management thereof can have long-term and adverse health outcomes.[1] Moreover, orofacial trauma including anterior tooth avulsion, may lead to various psychological effects such as the loss of confidence and, possible loss of a job or inability to obtain work, especially in fields where physical appearance is regarded as being important (such as frontline sales and retail jobs). In addition, there may be a negative aesthetic consequence of these injuries, as they occur on the part of the body that is almost always exposed and visible. Effects such as facial scarring, disfigurement and deformation, loss of function, and paralysis may occur and often cannot be disguised or hidden. Additionally, casualties may require extensive and expensive plastic and reconstructive surgery to restore some aesthetics and function.[2] There may also be significant social interaction difficulties and even social avoidance[3], which could be ascribed to embarrassment and a fear of rejection.[4] This delay may be related to access to

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immediate care, financial costs of treatment, fear of pain, and suffering.[1]

Therefore, it is essential to provide timeous and appropriate treatment in cases of orofacial trauma.[5] This is well known to dental professionals and is deeply embedded in their training. However, they may not be the first responders to such orofacial injuries due to serious vehicle accidents, work or sports injuries, interpersonal violence, or other miscellaneous activities. [6,7]

This prehospital care is usually provided by first responders such as emergency care providers attending an accident scene.[8] Several studies show that management of orofacial trauma is often not included in medical courses and first aid training nor in first-aid textbooks and training manuals of first responders to trauma such as ECPs. [9,10]

While research on an international level regarding orofacial trauma and the knowledge of ECPs in managing such trauma is substantial, in South Africa, there is a lack of epidemiological studies on the understanding of emergency care providers in managing these conditions.

OBJECTIVES OF THE STUDY

The study aimed to determine the knowledge, attitudes, and practices among emergency care providers' in managing dental emergencies.

METHODOLOGY

This was an exploratory, descriptive study employing quantitative and qualitative methods to achieve the objectives. The researcher obtained ethical approval from the Social Sciences and Humanities Research Ethics Committee (SSHREC Reference number: 068/16) and the KZN Department of Health (Reference number: 26/16 KZ-2015RP12-306). This study was completed in 2018.

The quantitative aspect involved participants (ECPs), employed by the local public sector Emergency Medical Services in the eThekwini Health District of KwaZulu-Natal, to complete a self-administered questionnaire on their knowledge, attitudes, and practices in the management of casualties presenting with orofacial trauma. A random sampling method, through the Surveymaker® software, was used to obtain the sample size. The sample size was calculated using a power calculation method with the following parameters: Sample size of 1138, Coefficient Index of 95% and, Standard Deviation of 0.96%, yielding a final sample size of 288. Using convenience sampling, participants were recruited at the start of their shifts in their workplaces and were informed about the study. All qualified ECPs registered with the Health Professional Council of South Africa (HPCSA), both male and female, employed by the provincial Department of Health Emergency Medical Services in the eThekwini District were included in the study. At the same time, those engaged in the private sector and student ECPs were excluded.

After obtaining informed consent from participants, the questionnaires were distributed to them to complete, in private, during their break times. The questionnaire included open and closed-ended questions and comprised four sections (demographics, knowledge, attitudes, practices, and further training needs). Sample questions included: Demographics (How many years of operational experience do you have in your profession?); Knowledge (Would you consider re-implantation of a primary (deciduous) avulsed tooth?); Attitudes (I am confident and comfortable treating common traumatic orofacial injuries and orofacial medical emergencies?); Practices (I know how to manage a tooth that is completely knocked out). The responses on attitudes and practices were rated on a Linkert scale ranging from strongly agree to strongly disagree. Construct validity was used in the construction of the questionnaires to maintain validity of the quantitative data. The researcher collected the questionnaires at the end of their shifts, and all completed questionnaires were coded to maintain participant anonymity.

The qualitative part of the study involved conducting semi-structured interviews with a purposively selected sample of ECPs, the managers from 7 bases (Tongaat, Phoenix, KwaMashu, Marianhill, R K Khan, Wentworth, and Umlazi) in the eThekwini Health District. The interviews were conducted using an interview schedule to gain an in-depth understanding of training and curriculum content regarding the emergency management of common orofacial trauma and dental emergencies. Sample questions include: Do you think there is adequate education and training offered to ECPs to manage common orofacial traumatic injuries and medical emergencies? and in your opinion, is further training required for ECPs in training to manage common orofacial trauma and medical emergencies efficiently? The interviews were conducted at the participants' convenience, in their offices, and lasted approximately 30 minutes. The researcher recorded the interviews with the participants' consent.

The quantitative data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 24® IBM 2016. Data analysis included descriptive statistics such as frequency and mean distribution and were presented as graphs and tables. Inferential statistical techniques, the Chi-Squared test, and the ANOVA Statistical test were used to determine associated relationships between the independent and dependent variables (knowledge, attitudes, and practices). The qualitative data obtained from the digital voice recordings were transcribed verbatim onto a Microsoft Word® document. In ensuring credibility, the researcher sent the data transcripts to the participants for verification to maintain dependability. Confirmability was established by quoting the participants' actual dialogue. The researcher analyzed the primary data manually to search for common patterns, which later emerged as themes and sub-themes according to Braun and Clark, 2010. [11]

RESULTS

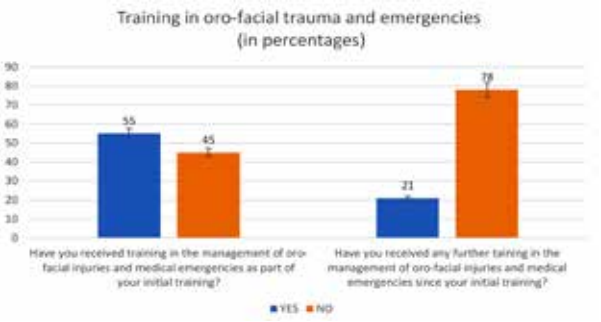
Of the 237 questionnaires distributed, only 138 were returned, yielding a 57.5% response rate. The majority of the study population were male (n=104, 75.4%) with most being within the age categories of 40-50 years (n= 54, 39.1%) and 30-40 years (n=50, 36.2%). Most (n=104, 75%) of the ECPs had a secondary medical

qualification, such as a rescue qualification, in addition to their basic paramedical qualification. The basic ambulance assistants had an average of 9.5 years of operational experience, in contrast to the higher qualified Critical Care Assistant, who had, on average, 20 years of experience. Those ECPs with a basic rescue qualification had over 21 years, while the more advanced medical rescue qualification holders had 10.8 years of experience, as reflected in Figure 1 below.

Figure 1: Operation experience of ECPs – medical and rescue qualifications

The differences observed in determining the ECPs training in the management of common orofacial injuries and medical emergencies during initial training was not significantly different(55% vs 45%), but significantly more respondents (78%) indicated that they did not receive any further training post-qualification, as shown in Figure 2.

Figure 2: ECP's training in dealing with orofacial medical emergencies



Knowledge of Oro-facial Trauma

A large number of respondents reported dealing with patients who presented with some type of dental injury (soft-tissue lacerations; 63.8%, Mandible fractures; 50%), yet just about half (n= 73, 53%) were able to identify the different teeth in the oral cavity. A significant number (n= 88, 64%) of the participants did not know when to re-implant an avulsed tooth, and 41% (n=57) did not know the proper process to preserve and implant an avulsed tooth.

When asked about the management of the potentially life-threatening orofacial condition of Ludwig's Angina, more than half of the study population (n=77, 55.5%) were unaware of this condition. Only14% (n= 19) of the participants recognized that the most critical sequel of Ludwig's angina is airway obstruction. Only 8% (n= 11) realized that Ludwig's angina is a bilateral swelling submandibular, sublingual and submental spaces.

Attitudes and Practices in Management of Oro-facial trauma

Just over 50% of participants agree (n=61, 44%) and (n= 13, 9.4%) strongly agree that they feel confident and comfortable when treating common traumatic orofacial injuries and medical emergencies (Table 1). Less than 50% (n=29, 21%) of the study population agreed that they could recognize severe complications from a dental abscess such as Ludwig's angina, and n=65 (47%) were confident in the management of post-op bleeding. Moreover, only 61 participants (44%) agreed that they were confident in assessing dental trauma, 58 (42%) were confident in the initial management of dental fractures. Only 41 participants (29.7%) agreed that they were confident in managing an avulsed tooth. Most of the respondents believed that they needed further training in the management of dental emergencies (n-79, 57.2% agreed and n=23, 16.7% strongly agreed).

When asked about their need for further training, a significant two-thirds (74%, $p < 0.001$) of the respondents agreed with the need for additional training. Interestingly, 80% of the respondents wanted this training to be offered by a dental practitioner, and 67.3% wanted training to be delivered at a formal lecture or workshop rather than online. Most (69%) of the participants wanted this training regularly (between 6 months to annually), and a significant number (n=91, 66%) wanted this training to be of a day's duration.

The emergent themes obtained from the analysis of the qualitative data pertained to mainly the training of ECPs as noted in an interview with an EMS base manager:

"*We are trained to deal with life-threatening emergencies, and unfortunately this does not include orofacial emergencies like an avulsed tooth. We tend to patch people up, and not really manage the emergency with a focus on the long-term effects and consequences. Our basic training has not equipped us to deal with things like bleeding following a dental extraction.*"

[Interview with EMS base manager A]

This could lead to the lack of confidence in the management of orofacial injuries as noted by participant B:

"*I was not confident when treating orofacial injuries as this was the role of the dental practitioner, but if I had received more training in both my basic training at college, and in further training after qualifying then perhaps, we would be more confident in dealing with these emergencies*"

[Interview with EMS Base manager B]

DISCUSSION

In a country like South Africa, plagued with high levels of criminal and interpersonal violence and high rates of motor vehicle and pedestrian accidents, there is an increased likelihood that ECPs will respond to several incidents wherein casualties present with orofacial traumas and injuries.[12] With a warm climate, many South Africans are active sports participants. This presents an additional risk to participants sustaining orofacial traumas, especially in aggressive contact sports such as rugby, boxing, and martial arts.[9] An adequate understanding

Table 1: ECP's knowledge, attitudes and confidence to deal with medical emergencies

		Strongly disagree		Disagree		Neutral		Agree		Strongly agree		Chi Square
		Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	p-value
I am confident and comfortable treating common traumatic orofacial injuries and medical emergencies	C1	12	8.7%	8	5.8%	44	31.9%	61	44.2%	13	9.4%	< 0.001
I have adequate knowledge on how to manage common traumatic orofacial injuries and medical emergencies.	C2	14	10.1%	19	13.8%	39	28.3%	57	41.3%	9	6.5%	< 0.001
I feel that I do require further training in the management of common traumatic orofacial injuries and medical emergencies.	C3	14	10.1%	4	2.9%	18	13.0%	79	57.2%	23	16.7%	< 0.001
I am confident in identifying a significant complication of a dental abcess such as Ludwig's Angina	C4	21	15.2%	24	17.4%	52	37.7%	29	21.0%	12	8.7%	< 0.001
I am confident in the management of post-extraction bleeding.	C5	19	13.8%	15	10.9%	30	21.7%	65	47.1%	9	6.5%	< 0.001
I am confident in the assessment of dental trauma.	C6	14	10.1%	16	11.6%	41	29.7%	61	44.2%	6	4.3%	< 0.001
I am confident in the initial management of dental fractures.	C7	18	13.0%	14	10.1%	41	29.7%	58	42.0%	7	5.1%	< 0.001
I am confident in the initial management of a partially dislodged tooth.	C8	17	12.3%	25	18.1%	37	26.8%	49	35.5%	10	7.2%	< 0.001
I am not confident in the initial management of a completely dislodged (avulsed) tooth.	C9		15		10.9%	34	24.6%	38	27.5%	41	7.2%	< 0.001

and knowledge of dealing with these types of injuries are essential for ECPs and first responders.[12] Inadequate knowledge of the management of orofacial injuries can have devastating and expensive consequences and lead to poor prognosis and outcomes.

This study demonstrated that ECPs have insufficient knowledge, skills, and confidence to render appropriate emergency management to casualties presenting with dental trauma and other dental emergencies. Just over 50% of participants agree (n=61, 44%) and (n= 13, 9.4%) strongly agree that they feel confident and comfortable when treating common traumatic orofacial injuries. ECPs who indicated that they had higher levels of knowledge were more optimistic in treating orofacial trauma. While noting the effect of seniority, both in terms of qualification and experience, it is of concern that the younger and often lower-qualified ECPs, have minimal confidence in managing such orofacial injuries. Yet, it is most likely that the younger ECPs would respond to a more significant number of incidents involving casualties with orofacial trauma, as they often work longer hours and have many years left in their careers. The prevalence of dental trauma worldwide ranges from 10% to 51%. [13]

Dental professionals are not the first responders for dental trauma, nor do they work in emergency rooms in healthcare facilities. Therefore it is inevitable that emergency care workers and medical professionals in emergency rooms will be required to provide emergency dental treatment before professional dental contact. These first responders need to be as confident in managing dental injuries as they would be in managing other injuries sustained elsewhere in the body. However, the literature indicates that even medical professionals are not confident or comfortable managing traumatic dental injuries, further widening the medical-dental divide. A study by Trivedy et al. (2012), conducted in the United Kingdom, found that most (88%) of the physicians were not confident in managing dentofacial emergencies.[14]

This lack of confidence stems from insufficient training or knowledge regarding the management of dental trauma. The study findings indicate that only 57 participants (41, 3%) agreed that they had sufficient knowledge of managing dental trauma and other dental emergencies. These findings were consistent with a recent report by Cruz-da-Silva et al. (2016), which showed that first responders had inadequate knowledge when dealing with cases of dental trauma, and Ulusoy et al. (2016), who reported that 41% of the respondents assessed their knowledge and management of dental trauma as insufficient. [15,16]

The prognosis of an avulsed tooth is dependent on the preservation of the tooth and the re-implantation time [17],yet in this study, 64% of the participants did not know when to re-implant an avulsed tooth, and 41% did not know the proper process to preserve and implant

an avulsed tooth. These findings were consistent with other studies by Joybell et al., 2019 conducted among emergency care workers in India.[18] The authors found that more than three-quarters of the 100 emergency care workers interviewed did not know the re-implantation procedures of avulsed teeth. Lack of knowledge can negatively affect the primary care of avulsed teeth and the management of other dental trauma or dental emergencies.

This lack of knowledge stems from not receiving adequate training in managing dental emergencies as medical and dental training occur separately. In this study, more than half the respondents (55 %%) indicated that they did not receive any formal training on dental trauma, while 78% stated that they did not receive any further training. This finding is similar to another study by Aren et al., 2018, in which 72.22% of the participants (first responders to trauma) did not receive any training on oral and dental health, and 97.62% did not attend any further den¬tal trauma management training; however, over 80% were willing to participate in training on this subject.[19] In this study, almost three quarter (73.9%) of the respondents expressed the need and desire for more education on managing dental emergencies. This was also reiterated by the managers interviewed. Continuing education, knowledge sharing by dental professionals, postgraduate programs, and interdisciplinary seminars will further enhance knowledge on the emergency management of dentoalveolar tooth injuries and other dental emergencies.

Limitations of the Study

The study was only conducted in the eThekwini district, which may affect the generalizability of the study findings. Another possible limitation is that the study population included only ECPs employed by the public sector; however, this decision was taken in the light that many private EMS have comparatively smaller work caseloads than public EMS. Further research is required to determine the knowledge, attitudes, and practices of ECPs in the private sector and other provinces in South Africa.

CONCLUSION

The findings of this study indicate that ECPs lack confidence in managing dental emergencies and suggest a need for specific dental awareness and continuing training programs to empower ECPs in the management of casualties better presenting with such emergencies.

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REFERENCES

1. Skapetis T, Gerzina, T, Hu W.Review Article: Management of dental emergencies by medical practitioners: Recommendations for Australian education and training', Emergency Medicine Australasia 2011; 23: 142-52.
2. Samaei H, Weiland T J, Dilley S, Jelinek GA. Knowledge and Confidence of a Convenience Sample of Australasian Emergency Doctors in Managing Dental Emergencies: Results of a Survey. Canadian Dental Journal 2015. Available at: http://europepmc.org/abstract/med/12513934. [Accessed 15 June 2017].
3. Robinson E, Rumsey N, Partridge J. An Evaluation of the Impact of Social Interaction Skills Training for Facially Disfigured People. British Journal of Plastic Surgery 1996; 49:281-89.
4. Zaleckiene V, Peciuliene V, Brukiene V, Drukteinis S. Traumatic dental injuries: etiology, prevalence and possible outcomes. Stomatologija 2014; 16(1):7-14.
5. Traebert J, Luiza M, Traiano R et al. Knowledge of lay people and dentists in emergency management of dental trauma. Dental Traumatology 2009; 25: 277-83.
6. Lalloo R.Risk factors for major injuries to the face and teeth. Dent Traumatology 2003; 19:12–4.
7. Pozner CN, Zare R, Nelson SJ, Levine M. International EMS Systems: The United States: past, present, future. Resusitation 2004; 60: 239-44.
8. Levine L, Zadi K. Education on and Prevention of Dental Trauma: It's time to act! Dental Traumatology 2012; 28: 49-54.
9. Zadik, Y. Oral trauma and dental emergency management recommendations of first-aid textbooks and manual. Dental Traumatology 2007; 22: 304-6.
10. Road Traffic Management Corporation (RTMC). (2016). Statement by Transport Minister Dipilo Peters on the occasion to release the preliminary festive season report for December 2015 and January 2016. Available at https://www.arrivealive.co.za/news.aspx?5=1 &1=22624 & page = Statement_by_Transport_Minister_Dipilo_Peters_on_the occasion_to _release_the_preliminary_festive_season_report_for_December_2015_and _January_2016 Accessed 30 December 2016. [Accessed 14 June 2017].
11. Braun V, Clarke V. Using thematic analysis in psychology. Qual Res Psychol 2010;3(2):77-101. https://doi.org/10.1191/1478088706qp063oa
12. MacFarlane C, van Loggerenberg C, Kloeck W. International EMS systems in South Africa: past, present, and future. Resuscitation 2005; 64(2):145-48.
13. Gassner R, Bösch R, Tuli T, Emshoff R. Prevalence of dental trauma in 6000 patients with facial injuries: implications for prevention. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1999; 87:27–33.
14. Trivedy C, Kodate N, Ross A, Al-Rawi H, Jaiganesh T, Harris T, et al. The attitudes and awareness of emergency department (ED) physicians towards the management of common dentofacial emergencies. Dent Traumatol 2012; 28:121–6.
15. Cruz-da-Silva, B. R., Perazzo, M., Neves, É. T., Firmino, R. T., & Granville-Garcia, A. F. Effect of an Educational Programme on the Knowledge Level Among an Emergency Service Medical Team Regarding Tooth Avulsion. Oral health & preventive dentistry, 2016; 14(3), 259–266.
16. Ulusoy AT, Onder H, Cetin B, Kaya S. Knowledge of medical hospital emergency physicians about the first-aid management of traumatic tooth avulsion. Int J Paediatr Dent 2012; 22:211–6.
17. Andersson L, Bodin I. Avulsed human teeth

replanted within 15 minutes-a long term clinical follow up study. Endod Dent Traumatol. 1990; 6:37–42.
18. Joybell CC, Kumar MK, Ramraj B. Knowledge, awareness, and attitude among the employees in emergency ambulance services towards traumatic dental injuries. J Family Med Prim Care 2019; 8:1043-8.
19. Aren A, Erdem AP, Aren G, Şahin ZD, Güney Tolgay C, Çayırcı M, et al. Importance of knowledge of the management of traumatic dental injuries in emergency departments. Ulus Travma Acil Cerrahi Derg 2018; 24:136–144

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Clinical academic staffing levels at a South African dental school

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ABSTRACT

Introduction

The inadequacy and skewed distribution of oral health personnel in South Africa are well-documented. Surprisingly, the staffing levels at dental schools have not previously been described.

Aims and objectives

To determine the number of full-time equivalent clinical academic staff working at the dental school of the Sefako Makgatho Health Sciences University for the five-year period 2015 to 2019.

Design

A retrospective cross-sectional descriptive study.

Methods

Data related to the demographic characteristics and employment types of clinical academic staff working at the dental school between January 2015 and December 2019 were acquired from annual reports, payroll records and school calendars and used to calculate full-time equivalents (FTE) by academic ranks and specialties.

Results

Females and Black general dental practitioners at lecturer level constituted the majority of staff. FTE of staff at lecturer level increased sharply between 2016 and 2017 (52.7 FTE vs 65.9 FTE respectively) and have since gradually declined. FTEs of staff at senior lecturer (15.8FTE vs 12.1FTE) and professorial (7.8 FTE vs 5.3FTE) levels have continued to decline. FTEs of staff working in the majority of specialties have decreased while staffing levels in Prosthodontics and Oral & Maxillofacial Surgery have increased.

Conclusion

Staffing levels declined between 2015 and 2019

INTRODUCTION AND BACKGROUND

The inadequacy and skewed distribution of oral health personnel in South Africa are well-documented.[1-3] The numbers of oral health personnel fall far short of accepted international standards.[4-6] Traditionally, four methods of calculating health personnel requirements at the national level have been applied: healthcare demands, health-needs approach, personnel to population ratios, and service targets.[7,8] The Workload Indicators of Staffing Need (WISN) method assists managers at the health facility level to determine how many health workers of a particular type are required to cope with the workload.[9]

The staffing levels in the country's dental schools have surprisingly not previously been described. In fact, very little has been written about the staffing situation in the country's dental schools.[10] A review of staff establishments is under way at Gauteng-based dental schools.[11] At present dental schools use student enrolment, among other factors, to determine staffing levels. The Health Professions Council of South Africa (HPCSA) which is a statutory body tasked with guiding the professions does not stipulate specific undergraduate faculty to student ratios. It does however require the schools to have a sufficient number of qualified staff to effectively deliver and evaluate the degree programmes.[12]

A teacher to student ratio is a measure of teacher workload. It is not the same as class size to which it is correlated. The relationship between teacher to student ratio and class size is affected by a variety of factors, including the number of classes for which a teacher is responsible and the number of classes taken by students. The lower the teacher/student ratio, the higher the availability of teacher services to students.[13] It is considered to be a proxy of quality.[14]

Final year dental students' perceptions of the quality of the learning environment at the four dental schools in the country have recently been surveyed.[15] The findings of the study are encouraging. They indicate that overall the students perceived their educational environment to be satisfactory. Their perceptions of lecturers were however concerning. The study found, among other things, that students perceived lecturers to be authoritarian.

A scarcity of full-time clinical faculty members in dental schools has been reported in the United Kingdom (UK) and the United States of America (USA).[16,17] Academic dentistry in South Africa, unlike in the USA, mainly involves teaching, research, and service responsibilities. In the USA faculty members can be either full-time clinician, clinician scholar or full-time researcher.[18] The Sefako Makgatho University Oral Health Centre (SMU Oral Health Centre), a dental school and a comprehensive care referral hospital, experienced a sharp increase in the number of patients between 2013 and 2018.[19] The impact of high patient load on teaching requirements

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and scholarship is undetermined. A downward trend in peer-reviewed publication output from the dental schools in the country has been reported - independent reviews spanning the periods 1990-1994 and 1990-2005 found a decline in research outputs.[20,21] Follow-up reviews of more recent outputs are an important issue for future research. Furthermore, a review of the participation of dental researchers at the annual International Association for Dental Research (IADR) conferences spanning the period 1967-2004 found that membership and with it the number of presentations per member has declined since reaching its peak in the 1980's.[22]

This study set out to determine the clinical academic staffing levels at the SMU Oral Health Centre in the five-year period 2015 to 2019.

OBJECTIVES OF THE STUDY

To describe the sociodemographic characteristics of clinical academic staff working at the SMU Oral Health Centre during the five-year period 2015 to 2019

To determine the number of full-time equivalent clinical academic staff.

MATERIALS AND METHODS

Study design

This was a retrospective cross-sectional descriptive study in which existing records were reviewed.

Target population

The target population consisted of annual reports, academic staff payroll records and calendars of the SMU Oral Health Centre spanning the five-year period 2015 to 2019.

Study sample

Every available record related to academic staff at SMU Oral Health Centre was studied.

Data collection

Data related to the demographic characteristics and employment types of clinical academic staff was acquired from annual reports and school calendars. Full-Time Equivalents (FTEs) of part-time staff were derived from payroll records.

Data was captured in Microsoft Excel software. It was then transferred to Statistical Package for the Social Sciences (SPSS) version 27 for analysis.

Definition of variables and terms

Population group breakdown of clinical academic staff into African, Indian, Coloured and White was applied according to the Population Registration Act of 1950.[23]

Full-time employee refers to any employee who works an average of at least 40 hours per week for more than 120 days in a year.

Part-time employee refers to any employee who works an average of less than 40 hours per week.

Full-Time Equivalents are defined as "the ratio of the total number of hours worked and the average number of hours worked in full-time jobs".[24] An FTE of 1.0 is equivalent to a full-time worker, while an FTE of 0.5 signals half of a full work load.

Dental specialist refers to a dentist who has been registered as a specialist in a speciality in dentistry in terms of the regulations under the Health Professions Act 56 of 1974.[25] There are six recognised specialties in South Africa. They are Community Dentistry, Maxillo-facial and Oral Surgery, Oral Medicine and Periodontics, Oral and Maxillofacial Pathology, Orthodontics and Prosthodontics.

General dental practitioner refers to a dentist who has been registered with the Health Professions Council for the provision of general dental services

Registrar refers to a dentist undergoing training as a specialist.

Professoriate refers to a body of professors i.e. associate and full professors.

Ethical considerations

Ethical approval for the study was granted by the Ethics Committee of Sefako Makgatho Health Sciences University (SMREC/H/167/2021:IR). Permission to conduct the study was granted by the Chief Executive Officer (CEO) of the SMU Oral Health Centre.

STATISTICAL ANALYSIS/HYPOTHESIS TESTING

Collected data were subjected to univariate and bivariate analysis in Statistical Package for the Social Sciences (SPSS) software. Frequencies, means and proportions were calculated. Chi-squared tests were performed to test the statistical significance of the differences in proportions. The chosen significance level of the tests was a p-value less than 0.05.

RESULTS

Data spanning the five-year period from 2015 to 2019 was extracted from annual reports, payroll records and school calendars and analysed.

Demographic characteristics

Female staff members constituted a majority throughout the study period. The differences in gender proportions were not statistically significant ($p>0.05$).

Black clinical academic staff constituted a large majority (63.4%). White clinical academic staff constituted the second largest population group between 2015 and 2017, while Indian clinical academic staff constituted the second largest population group between 2018 and 2019. The professoriate comprised an average of 8.2% of clinical academic staff. The number of full-time professors decreased from four in 2015 to two between 2017 and 2019 representing a 50% decline.

The proportion of senior lecturers ranged between 12.7% and 19.2%. Lecturers constituted the bulk of clinical academic staff. A significant increase in the number (62 vs 86) of lecturers occurred between 2016 and 2017. A steady increase in their proportion has since been maintained. Part-time lecturers comprised 31.1% of clinical academic staff in 2019.

Distribution, gender and racial composition of the professoriate

Of the four full-time professors, two worked in Oral Pathology while one worked in Oral Medicine and Periodontics and one in General Dental Practice. Of the

three full-time associate professors, two worked in Oral Medicine and Periodontics and the third in Dental & Maxillofacial Radiology.

Of the four part-time professors, two worked in Restorative Dentistry while one worked in Oral & Maxillofacial Surgery and one in Prosthodontics. All part-time professors were retired. Female representation in the professoriate during the study period ranged between 14.3% and 25%. The racial breakdown during the study period ranged between 75% to 85.7% White and 14.3 to 25% Indian. Blacks and Coloureds were not represented.

The distribution of oral health personnel by categories was: general dental practitioners (53.6%); dental specialists (23%); oral hygienists (3.9); dental therapists (2.3%); dental radiographers (3.5), and registrars (13.3%). A little less than forty percent (39.2%) of the general dental practitioners were employed part-time.

Table 1: Gender distribution of clinical academic staff over the five-year period

Year	Gender		Chi-squared test
	Male n (%)	Female n (%)	
2015	43 (44.3)	54 (55.7)	p = 0.979
2016	41 (43.6)	53 (56.4)	
2017	49 (43.0)	65 (57.0)	
2018	45 (40.9)	65 (59.1)	
2019	43 (41.7)	60 (58.3)	

Table 2: Distribution of clinical academic staff by population groups over the five-year period

Year	Population groups				Total n (%)
	Black n (%)	Indian n (%)	Coloured n (%)	White n (%)	
2015	60 (61.9)	15 (15.5)	1 (1.0)	21 (21.6)	97 (100)
2016	58 (61.7)	15 (16.0)	1 (1.1)	20 (21.3)	94 (100)
2017	73 (64.0)	18 (15.8)	1 (0.9)	22 (16.3)	114 (100)
2018	72 (65.5)	19 (17.3)	1 (0.9)	18 (16.4)	110 (100)
2019	66 (64.1)	18 (17.5)	1 (1.0)	16 (15.5)	103 (100)

Table 3: Types of employment of clinical academic staff by academic ranks over the five-year period

Year	Types of employment									Total n (%)
	Full-time					Part-time				
	Dev Lecturer	Lecturer n (%)	Snr Lecturer. n (%)	Assoc. Prof n (%)	Prof n (%)	Lecturer n (%)	Snr Lecturer n (%)	Assoc. Prof n (%)	Prof n (%)	
2015	5 (5.2)	47 (48.5)	15 (15.5)	2 (2.1)	4 (4.1)	17 (17.5)	3 (3.1)	0 (0)	4 (4.1)	97 (100)
2016	4 (4.3)	45 (47.9)	12 (12.8)	3 (3.2)	3 (3.2)	17 (18.1)	6 (6.4)	0 (0)	4 (4.3)	94 (100)
2017	4 (3.5)	52 (45.6)	12 (10.5)	2 (1.8)	2 (1.8)	34 (29.8)	4 (3.5)	0 (0)	4 (3.5)	114 (100)
2018	4 (3.6)	52 (47.3)	13 (11.8)	2 (1.8)	2 (1.8)	32 (29.1)	1 (0.9)	0 (0)	4 (3.6)	110 (100)
2019	3 (2.9)	48 (46.7)	12 (11.7)	2 (1.9)	2 (1.9)	32 (31.1)	1 (1.0)	0 (0)	3 (2.9)	103 (100)

Table 4: Categories of oral health personnel and types of employment over the five-year period

Categories of oral health personnel	Types of employment									
	Full-time					Part-time				
	2015 n (%)	2016 n (%)	2017 n (%)	2018 n (%)	2019 n (%)	2015 n (%)	2016 n (%)	2017 n (%)	2018 n (%)	2019 n (%)
Dental specialists	15 (20.5)	13 (19.4)	12 (16.7)	16 (21.6)	16 (23.9)	7 (29.2)	10 (37.0)	13 (31.0)	9 (25.0)	8 (22.2)
General dental practitioners	35 (47.9)	32 (47.8)	34 (47.2)	36 (48.6)	32 (47.8)	16 (66.7)	16 (59.3)	28 (66.7)	24 (66.7)	25 (69.4)
Registrars	14 (19.2)	13 (19.4)	17 (23.6)	14 (18.9)	11 (16.4)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Oral hygienists	3 (4.1)	3 (4.5)	3 (4.2)	3 (4.1)	3 (4.5)	1 (4.2)	1 (3.7)	1 (2.4)	2 (5.6)	2 (5.6)
Dental therapists	2 (2.7)	2 (3.0)	2 (2.8)	2 (2.7)	2 (3.0)	0 (0)	0 (0)	0 (0)	1 (2.8)	1 (2.8)
Dental radiographers	4(5.5)	4 (6.0)	4 (5.6)	3 (4.1)	3 (4.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Total	73 (100)	67 (100)	72 (100)	74 (100)	67 (100)	24 (100)	27 (100)	42 (100)	36 (100)	36 (100)

Table 5: Proportions of non-specialist oral health personnel who held a Master's degree over the five-year period

Categories of non-specialist personnel	Year				
	2015 n (%)	2016 n (%)	2017 n (%)	2018 n (%)	2019 n (%)
General dental practitioners	(19/51) 37.3	(15/48) 31.3	(17/62) 27.4	(17/60) 28.3	(17/57) 29.8
Dental therapists	(1/2) 50	(1/2) 50	(1/2) 50	(1/3) 33.3	(1/3) 33.3
Oral hygienists	0	0	0	0	0
Registrars	(3/14) 21.4	(3/13) 23.1	(2/17) 11.8	(2/14) 14.3	(1/11) 9.1

Table 6: Types of employment of clinical academic staff by specialities over the five-year period

Specialties	Types of employment									
	Full-time					Part-time				
	2015 n (%)	2016 n (%)	2017 n (%)	2018 n (%)	2019 n (%)	2015 n (%)	2016 n (%)	2017 n (%)	2018 n (%)	2019 n (%)
Orthodontics	9 (12.3)	8 (11.9)	9 (12.5)	7 (9.6)	7 (10.4)	2 (8.3)	2 (7.4)	3 (7.1)	3 (8.1)	3 (8.3)
Oral Medicine and Periodontics	7 (9.6)	7 (10.4)	7 (9.7)	8 (11.0)	6 (9.0)	1 (4.2)	1 (3.7)	5 (11.9)	6 (16.2)	5 (13.9)
Prosthodontics	6 (8.2)	5 (7.5)	7 (9.7)	10 (13.7)	10 (14.9)	8 (33.3)	11 (40.7)	10 (23.8)	5 (13.5)	5 (13.9)
Community Dentistry	11 (15.1)	8 (11.9)	10 (13.9)	11 (15.1)	10 (14.9)	2 (8.3)	2 (7.4)	2 (4.8)	3 (8.1)	3 (8.3)
Oral Pathology	6 (8.2)	6 (9.0)	5 (6.9)	4 (5.5)	3 (4.5)	0	0 (0)	0 (0)	0 (0)	0 (0)
Oral & Maxillofacial Surgery	10 (13.7)	9 (13.4)	11 (15.3)	11 (15.1)	11 (16.4)	2 (8.3)	2 (7.4)	11 (26.2)	10 (27.0)	10 (27.8)
General Dental Practice	9 (12.3)	8 (11.9)	8 (11.1)	8 (11.0)	7 (10.4)	2 (8.3)	2 (7.4)	4 (9.5)	3 (8.1)	3 (8.3)
Dental & Maxillofacial Radiology	7 (9.6)	7 (10.4)	6 (8.3)	5 (6.8)	5 (7.5)	2 (8.3)	2 (7.4)	2 (4.8)	2 (5.4)	2 (5.6)
Restorative Dentistry	7 (9.6)	8 (11.9)	8 (11.1)	8 (11.0)	7 (10.4)	5 (20.8)	5 (18.5)	5 (11.9)	5 (13.5)	5 (13.9)
Oral Microbiology	1 (1.4)	1 (1.5)	1 (1.4)	1 (1.4)	1 (1.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Total n (%)	**73 (100)**	**67 (100)**	**72 (100)**	**73 (100)**	**67 (100)**	**24 (100)**	**27 (100)**	**42 (100)**	**37 (100)**	**36 (100)**

The proportion of general dental practitioners who held a Master's degree ranged between 27.4% and 37.3%. A significant proportion, ranging from 9.1% to 23.1%, of registrars held a Master's degree.

A little more than two-thirds (68%) of the clinical academic staff were employed full-time. Full-time staff in most specialties were in the low to mid-teen percentage. The specialty of Oral Pathology experienced a steady decline in the number of full-time staff from 2016. The specialty of Prosthodontics employed four out of ten part-time staff in 2016. A significant increase (7.4% vs 26.2%) in the proportion of part-time clinical academic staff occurred between 2016 and 2017 in the specialty of Oral & Maxillofacial Surgery. A steady increase has since been maintained.

The FTE of clinical academics at lecturer level increased sharply between 2016 and 2017 and have since gradually declined.

The FTE of clinical academics at senior lecturer level have continued to decline (12.1), representing a FTE change of -23.4% since 2015, when senior lecture FTE was 15.8 The FTE of clinical academics at professorial level have continued to decline (5.3 FTE), representing a FTE change of -32.1% since 2015, when professorial FTE was 7.8.

The FTE of clinical academics have steadily declined from a high of 89.1FTE in 2017 to a low of 81.4FTE in 2019. This represents an 8.6% decrease in staffing since 2017.

FTEs of clinical academics working in the majority of specialties have decreased while staffing levels in Prosthodontics and Oral & Maxillofacial Surgery have increased Staffing levels in Oral Pathology declined substantially (3 FTE) in 2019, representing a FTE change of -50% since 2015 when the FTE was 6.

DISCUSSION

This study set out to calculate the FTEs of clinical academic staff at the SMU Oral Health Centre for the five-year period 2015 to 2019.

Sociodemographic characteristics

The results of this study show that females and Black general dental practitioners at lecturer level constituted the majority (Tables 1, 2 and 3). This finding is supported by previous research which found a sharp increase in the number of female and Black dentists between 2002 and 2015.[21]

The results of this study indicate that a little less than forty percent (39.2%) of the general dental practitioners were employed part-time (Table 4). This finding was not

Table 7: FTEs of clinical academic staff by academic ranks over the five-year period

Year	Academic ranks					Total n (%)
	Developmental n (%)	Lecturer n (%)	Snr Lecturer. n (%)	Assoc. Prof n (%)	Prof n (%)	
2015	5 (6.0)	54.5 (65.6)	15.8 (19.0)	2 (2.7)	5.8 (7.0)	83.1 (100)
2016	4 (5.1)	52.7 (67.0)	14.2 (18.0)	3 (3.8)	4.8 (6.1)	78.7 (100)
2017	4 (4.5)	65.9 (74.0)	13.5 (15.2)	2 (2.2)	3.8 (4.3)	89.1 (100)
2018	4 (4.6)	64.6 (73.8)	13.1 (15.0)	2 (2.3)	3.8 (4.3)	87.5 (100)
2019	3 (3.7)	61.1 (75.1)	12.1 (14.9)	2 (2.5)	3.3 (4.1)	**81.4** (100)

Table 8: FTEs of clinical academic staff by specialities over the five-year period

Specialties	Year				
	2015 n (%)	2016 n (%)	2017 n (%)	2018 n (%)	2019 n (%)
Orthodontics	9.4 (11.3)	8.4 (10.7)	9.8 (11.0)	7.8 (8.9)	7.8 (9.6)
Periodontics	7.1 (8.5)	7.1 (9.0)	7.8 (8.8)	9.1 (10.4)	7.1 (8.7)
Prosthodontics	9.6 (11.6)	10.1 (12.8)	11.9 (13.4)	12.3 (14.1)	12.3 (15.1)
Community Dentistry	12 (14.4)	9 (11.4)	11 (12.3)	12.5 (14.3)	11.5 (14.1)
Oral Pathology	6 (7.2)	6 (7.6)	5 (5.6)	4 (4.6)	3 (3.7)
Oral & Maxillofacial Surgery	10.9 (13.1)	9.9 (12.6)	15.5 (17.4)	15.3 (17.5)	15.3 (18.8)
General Dental Practice	10 (12.0)	9 (11.4)	10 (11.2)	9.5 (10.9)	8.5 (10.4)
Dental & Maxillofacial Radiology	8 (9.6)	8 (10.2)	7 (7.9)	6 (6.9)	6 (7.4)
Restorative Dentistry	9.3 (11.2)	10.3 (13.1)	10.3 (11.6)	10.1 (11.5)	9.1 (11.2)
Oral Microbiology	1 (1.2)	1 (1.3)	1 (1.1)	1 (1.1)	1 (1.2)
Total n (%)	83.1 (100)	78.7 (100)	89.1 (100)	87.5 (100)	81.4 (100)

unexpected for the reason that between 70% and 80% of the dentists are employed in the private sector.[21] A previous unrepresentative study (41.25% response rate) reported that more than two-thirds (68%) of full-time academic dentists employed at the dental schools in South Africa came from private practice.[12]

It is interesting to note that a large majority (more than two-thirds) of the general dental practitioners did not hold a Master's degree (Table 5). This result contrasts sharply with that from a previous unrepresentative study (41.25% response rate) which found that the majority of full-time academic dentists had completed a Master's degree.[12] It may be explained by the fact that general dental practitioners are not required to possess a Master's degree as a condition of employment. It is however concerning that few general dentists make good use of opportunities to develop themselves.

Staffing levels

The results of this baseline study indicate that SMU Oral Health Centre experienced a net decline of 1.9 FTE between 2015 and 2019 i.e. FTE of clinical academics rose from a base of 83.1 FTE in 2015 to a high of 89.1FTE in 2017 and then decreased to 81.4FTE in 2019. This represents an 2.3% decrease in staffing since 2015. Comparable local studies were not found – staffing levels in the country's other dental schools have not previously been described. Considering the difference in the size of the economies between South Africa and the United Kingdom (UK), it is interesting to note that an average of 33.7 full-time equivalent (FTE) clinical academics were employed at 18 dental schools across the UK in 2017 - the aggregate FTE was 607.3.[28] A summary and discussion of the results by academic ranks and specialities follows.

Lecturer

The current study found that the FTE of clinical academics at lecturer level increased sharply between 2016 and 2017 (Table 7). The observed increase could be attributed to the substantial increase in the number of part-time lecturers (Table 3). This curious finding may be related to the 2016 HPCSA accreditation visit - the HPCSA require the schools to have a sufficient number of qualified staff to effectively deliver and evaluate the degree programmes.[12]

The results of this study indicate paradoxically that while the FTE of clinical academics at lecture level declined gradually from 2017, their proportion among clinical academics increased steadily (Tables 3 and 7). This rather contradictory result is due to the decline in the numbers of part-time clinical academics at senior lecturer level and full-time professors between 2017 and 2019 owing to resignations.

Senior lecturer

The results of this study indicate that the proportion of senior lecturers ranged between 12.7% and 19.2%. and that their FTE has continued to decline (12.1), representing a FTE change of -23.4% since 2015 when

senior lecture FTE was 15.8 (Table 7). This finding when considered together with the continued decline in the number of full-time professors implies that the number of research active clinical academics has decreased. This is reflected in the decreased research outputs of affected specialties.

Professoriate

The most interesting finding was that the professoriate comprised an average of 8.2% of clinical academic staff (Table 3). This result reflects the national downward trend.[26]

Another important finding was that the FTE of clinical academics at professorial level has continued to decline (5.3 FTE), representing a FTE change of -32.1% since 2015 when professorial FTE was 7.8 FTE (Table 7). This rather disappointing finding may be explained by the decrease in the number of full-time professors from four in 2015 to two between 2017 and 2019, representing a 50% decline (Table 3). These findings suggest that experienced senior clinical academic staff were replaced with lower ranking, less educated and less experienced staff members.

The results of this study indicate that females were underrepresented while Blacks and Coloureds were not represented. The findings of the current study do not support the previous research which found a changing demography of academic staff at South African universities.[27] In this study, Black and Coloured academics do not represent their national population representation. This is the legacy of the apartheid past.

It is interesting to note that the specialties of Oral Medicine and Periodontics and Oral Pathology were overrepresented in the professoriate. This finding is mirrored in the contribution of these specialties to the research output of the school.

Specialties

The results of this study indicate that while the FTEs of clinical academics working in the majority of specialties have decreased, more so in the specialty of Oral Pathology, staffing levels in Prosthodontics and Oral & Maxillofacial Surgery have increased (Tables 6 and 8). These results are contrary to those reported in a survey of dental schools in the United Kingdom, which found that staffing levels in most specialties increased while the FTE of those working in Oral & Maxillofacial Surgery declined.[28] Differences in patients' profile may account for this discrepancy. Another possible explanation for the increased staffing levels in Prosthodontics and Oral & Maxillofacial Surgery at SMU Oral Health Centre is that the prevalence of interpersonal violence in South Africa is high.[29,30]

Limitations of the study

The age distribution of clinical academic staff could not be described as data was not available.

CONCLUSION

Staffing levels declined between 2015 and 2019.

REFERENCES

1. van Wyk PJ, Kroon FJ, Cleaton-Jones JPE. Geographical distribution of dental operators in South Africa over the period 1972-1992. SADJ. 1994; 49:457-62
2. Lalloo R. A national human resources plan for oral health: is it feasible? SADJ. 2007; 62(8):360-4.
3. Bhayat A, Chikte U. Human Resources for Oral Health Care in South Africa: A 2018 Update. Int J Environ Res. Public Health 2019; 16(10): 1668; doi:10.3390/ijerph16101668
4. WHO. The global health observatory. Retrieved from https://www.who.int/data/gho/indicator-metadata-registry/imr-details/5323 [Accessed 28/02/2022].
5. Yadav R, Rai R. Dental education: Do we really have too many graduates? Br Dent J 2016; 220 (11): 558
6. Bhayat A, Chikte U. The changing demographic profile of dentists and dental specialists in South Africa: 2002-2015. Int Dent J. 2018 ;68(2):91-96.
7. Hall T, Mejia A. Health manpower planning: principles, methods, issues. 1978, Geneva: World Health Organization.
8. Green A. An Introduction to Health Planning in Developing Countries: Oxford University Press, 1992.
9. World Health Organization. Workload Indicators of Staffing Need (WISN) Tool. Retrieved from https://www.who.int/workforcealliance/knowledge/toolkit/17/en/[Accessed 05/10/2020]
10. Mostert VC. Reasons why South African dentists chose a career in Dentistry, and later opted to enter an academic environment. SADJ. 2018;73(3):141-5
11. Gauteng Department of Health. Institutional organogram. Unpublished confidential document; 2022
12. HPCSA. Accreditation of undergraduate dental education and training. Unpublished confidential document; 2016
13. OECD (2019). Education at a Glance 2019: OECD Indicators, OECD Publishing, Paris https://www.oecd-ilibrary.org/sites/a1ef3bfe-n/index.html?itemId=/content/component/a1ef3bfe-en [Accessed 21/02/2022]
14. McDonald, G. (2013), "Does size matter? The impact of student-staff ratios", Journal of Higher Education Policy and Management. 2013;35(6): 652-67.
15. Bhayat A, Barrie R, Motloba P, Yengopal V. The South African Schools Educational Environment: Final Year Students' Perceptions at Four Dental Schools. JCDR 2018; 12(2): ZC40-4.
16. John V, Papageorge M, Jahangiri L 'et al'. Recruitment, development, and retention of dental faculty in a changing environment. J Dent Educ. 2011;75(1):82-9.
17. Patel N, Petersen HJ. Would you choose an academic career? Views of current dental clinical academic trainees. Br Dent J. 2015; 218 (5): 297-301.
18. John V, Papageorge M, Jahangiri L 'et al'. Recruitment, development, and retention of dental faculty in a changing environment. J Dent Educ. 2011;75(1):82-9.
19. Mthethwa SR, Ramphoma KJ. The referral system for specialist dental services at Sefako Makgatho Oral Health Centre: a cross-sectional study. SADJ. 2021;76(10):618-23
20. Dreyer WP, van Wyk CW. Peer-reviewed oral and dental research output in South Africa, 1990-1994. SADJ. 1996 ;51(12):726-9.
21. Cleaton-Jones P. Peer-reviewed publication output from South African dental schools 1990-2005. SADJ.

2008;63(2):114-6.
22. Grossman ES. Participation of dental researchers at annual IADR conferences (1967-2004): drivers and passengers. SADJ. 2008;63(1):10-14.
23. Union of South Africa (1950). Population Registration Act, No. 30 of 1950, in SA Government Gazette.
24. Statistics South Africa. Labour accounts for South Africa. A discussion document by Statistics South Africa. October 2005. http://www.statssa.gov.za/publications/D0403/D0403.pdf [Accessed 21/02/2022]
25. Legislation - HPCSA. Retrieved from http://www.hpcsa.co.za/Legal/Regulatory Affairs/Legislation [Accessed 28/02/2022].
26. Breetzke GD, Hedding DW. The changing demography of academic staff at higher education institutions (HEIs) in South Africa. Higher Education 2018;76(1):145–61.
27. Breetzke GD, Hedding DW. The changing racial profile of academic staff at South African Higher Education Institutions (HEIs), 2005–2013, Africa Education Review. 2016; 13(2): 147-64,
28. Dental Schools Council. Survey of Dental Clinical Academic Staffing Levels. A report by the Dental Schools Council 2018. August 2018. https://www.dentalschoolscouncil.ac.uk/wp-content/uploads/2018/08/clinical-academic-survey-dental-2018.pdf [Accessed 21/02/2022]
29. Norman R., Schneider M., Bradshaw D 'et al'. Interpersonal violence: an important risk factor for disease and injury in South Africa. Popul Health Metrics 2010; 8 (1): 32
30. Mogajane BM, Mabongo M. Epidemiology of maxillofacial fractures at two maxillofacial units in South Africa. SADJ. 2018;73(3):132-6.

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Traditional and Conservative Molar Endodontic Access Cavity Designs: *A Classification and Overview*

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ABSTRACT

Minimally invasive endodontics' specific focus on dentine preservation is gaining popularity. Before deciding on the appropriate endodontic access cavity design, clinicians should investigate the advantages and disadvantages associated with different treatment modalities.

The purpose of this article is to provide a summary of possible advantages and disadvantages of different endodontic access cavity designs with the focus on traditional, conservative and ultra-conservative endodontic access cavities, specifically in molar teeth.

No conclusive evidence is found in the literature favouring one access cavity design above another and clinicians are advised to evaluate each case individually when deciding on the appropriate access cavity design for that specific case. Fracture resistance, proper shaping in order to facilitate irrigation and disinfection, as well as canal location and orifice detection are some of the contributing factors in selecting an appropriate access cavity design that will be highlighted in this article.

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Introduction

Non-surgical endodontic treatment starts with the preparation of an endodontic access cavity (EAC). Many variations and modifications on EAC designs can be found in literature with more recent EAC focussing on the preservation of tooth structure. The exact parameters of each of the different EAC designs however remain largely undefined. EAC preparation includes the removal of caries, the removal of the pulp roof, straight-line access and the identification and location of root canal orifices whilst preserving dentine.[1] Advances in clinical dentistry has made more conservative access cavity preparations a viable option. These advances include magnification, cone beam computed tomography (CBCT), irrigation activation devices and solutions, as well as improved metallurgy for the manufacturing of endodontic shaping instruments resulting in increasing flexibility and fracture resistance.[2,3]

The greatest challenge in terms of the long-term success/longevity of endodontically treated teeth is still the reduction of fracture resistance. Fracture of endodontically treated teeth is a major reason for extraction post endodontic treatment.[4,5] Tooth structure integrity and the preservation of dentine during access cavity preparation and canal shaping are considered to optimize the biomechanical behaviour of these teeth and increase their long-term resistance to failure due to possible fracture.[6-9]

Research shows that the susceptibility of endodontically treated molar teeth to fracture can mainly be contributed to significant tooth strength decrease during access cavity preparation and root canal cleaning and shaping.[9-12] Corsentino et al.[13] reported that the loss of one or more marginal ridges, regardless of the amount of dentine loss or size of access cavity preparation, should be considered the major contributing factor in the decrease in fracture resistance of endodontically treated molars.Therefore the amount of remaining dentine after access cavity preparation and root canal shaping as well as the structural integrity of marginal ridges appears to be the major contributing factors in determining the fracture resistance and long-term prognosis in teeth post-endodontic treatment.[14]

Structural integrity of pericervical dentine specifically could be a key factor in determining the long-term prognosis with specific reference to fracture resistance of endodontically treated teeth.[15] The term pericervical dentine was first described by Clark and Khademi[16] and refers to an area roughly 4mm coronal to the crestal bone and 6mm apical to the crestal bone (Fig 1). It is considered to be critical dentine for tooth strength and should be conserved as much as possible to ensure long-term retention of the tooth.

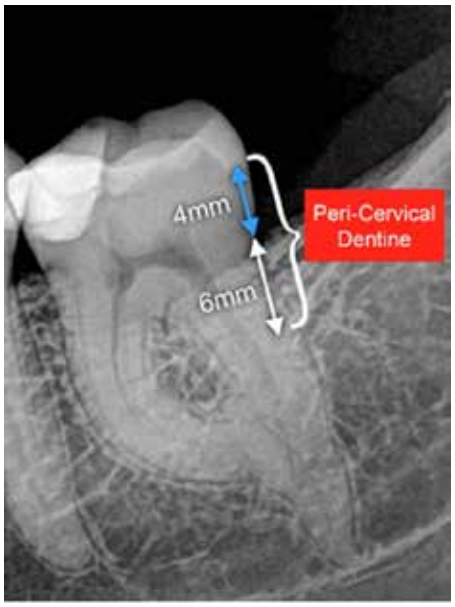

Figure 1: Pericervical dentine: 4mm coronal to the crestal bone and 6mm apical to the crestal bone.

In a study by Ozyurek et al.[17] the authors concluded that conservative access cavity design did not increase the fracture resistance compared to traditional access cavity preparation groups. On the contrary, Zhang et al.[12] in a recent study found that conservative access cavity preparations increased the fracture resistance of endodontically treated teeth compared to the conservative access cavity preparation groups.[12]

In this article the authors will give a classification of different molar access cavity designs as well as provide insight in the possible benefits and disadvantages of each of the proposed access cavity designs.

Classification of Endodontic Access Cavities

Literature shows a wide variety of minimally invasive access cavity designs with a significant amount of discrepancies in their definitions, descriptions and dimensions. Below the authors will highlight the three main access cavity designs in molars and give a description that is mostly accepted in literature.

Traditional access cavities (TAC)

Traditional access cavities are prepared by obtaining straight line access into the coronal and middle third of the root canal systems (Fig 2). The entire roof of the pulp chamber has to be removed, resulting in more loss of pericervical dentine.[1,18,19]

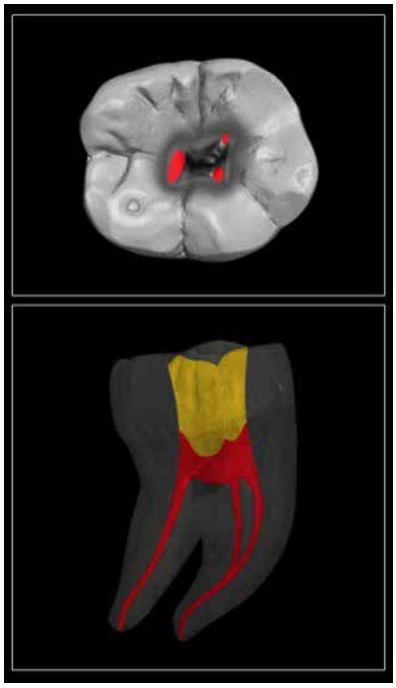

Figure 2: Micro-computed tomographic illustration of a mandibular molar showing a traditional access cavity preparation from occlusal and buccal views.

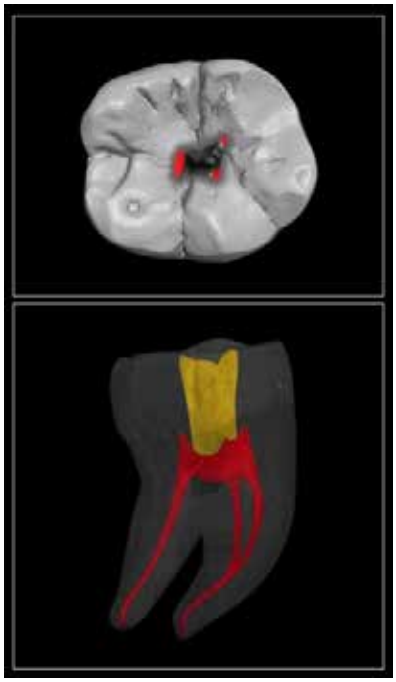

Figure 3: Micro-computed tomographic illustration of a mandibular molar showing a conservative access cavity preparation from occlusal and buccal views.

Conservative access cavities (CAC)

Recently, a new concept of conservative access cavity (CAC) preparation has been developed,aiming for a minimally invasive dentistry and dentine preservation (Fig 3).[20] This design limits the removal of dentine of the chamber roof allowing for the location of root canals without necessarily achieving straight line access. Preparation starts at the central fossa extending the access in such a way that the canals

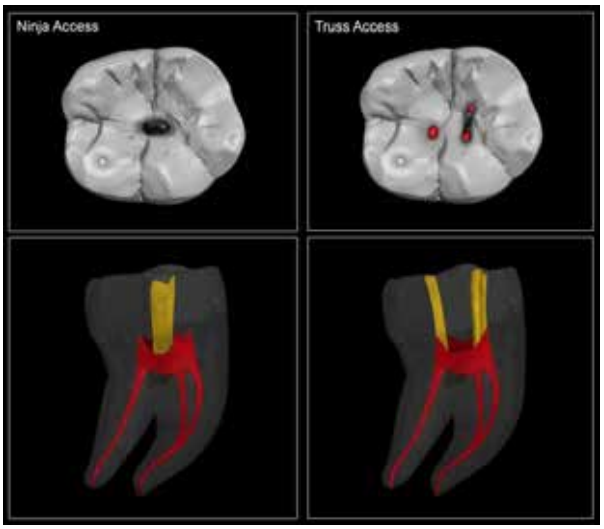

Figure 4: Micro-computed tomographic illustration of a mandibular molar showing ultra-conservative access cavity preparations (a: Ninja access b: Truss access) from occlusal and buccal views.

are detected without deroofing the entire pulp. Access cavity walls can either be convergent or divergent.[12,13] The emphasis being on partial removal of the pulp chamber roof. This design minimizes the amount of dentine and specifically pericervical dentine removal.

Ultra-conservative access cavities (UAC)

Ultra-conservative access cavities aim to preserve as much as possible tooth structure. Pericervical dentine preservation is the only objective and straight-line access or visibility is often compromised. Ninja access cavities (Fig 4a) is a form of ultra-conservative access cavity preparation prepared by a "point access" in the central fossa.[21] Truss access (Fig 4b) is another form of UAC designs. The design is aimed in targeting the canal orifices without breaking the dentine structure between the mesial and distal canals.[22]

Review of Literature

When evaluating remaining tooth structure there is consensus that CAC and UAC preserves more coronal tooth structure and pericervical dentine than TAC preparations. Many authors however reported no difference between different access cavity designs and the amount of dentine removed from the root canal system itself.[22-26]

When evaluating the stress distribution between TAC and CAC, most studies concluded that TAC showed a significant higher stress generation than CAC. [12,27] Moore et al.[20] found no difference in fracture resistance nor instrumentation efficacy between CAC and TAC groups in maxillary molars. Chlup et al.[28] also found no significant difference between the two EAC groups when evaluating fracture resistance. They did however report that higher fracture load was required in the CAC group to initiate fractures. Although most studies indicated no significant difference in fracture resistance between these two types of EAC preparations in posterior teeth[21,22] some studies found a decreased fracture resistance in TAC compared to CAC in posterior teeth.[12,18,29] A study by Plotino et al.[30] evaluating the fracture resistance of endodontically treated teeth with different access cavity designs found that teeth with TAC designs showed lower fracture resistance than teeth with CAC designs. In this study the UAC did not show any increase in fracture resistance compared to the CAC designs.[30] Zhang et al.[12] investigated the effect of different access cavity designs on the fracture resistance of first maxillary molars by using the extended finite element method. The authors found that CAC designs lower the stresses in the cervical region, resulting in increased fracture resistance compared to TAC design. The authors therefore recommended minimal removal of dentinal hard tissue in order to increase the fracture resistance of endodontically treated teeth.[12]

Santosh et al.[31] also found that minimally invasive access cavity designs improved fracture resistance in mandibular endodontically treated molars. The authors further found that in the CAC groups more favourable, restorable fractures were seen with an increase in long term survival of endodontically treated teeth.[31] Krishan et al.[29] also concluded in a study evaluating fracture resistance of endodontically treated teeth with different EAC designs, that although CAC has an improved fracture resistance compared to TAC, there is an increased risks of inadequate canal instrumentation as well as an increased risk of procedural errors.

When the amount of uninstrumented areas of the root canal system is evaluated in posterior teeth, using micro-CT, some studies favour the TAC[22,26,29] while others showed no difference between the two groups with regards to uninstrumented canal space.[19-21,32] A study by Neelakantan et al.[18] showed that access cavity design type had a significant effect on the debridement of the mesial pulp chambers in mandibular molars. The results of this study suggest that the orifice-directed approach shows inferior debridement compared to TAC. This is a key factor to consider as failure to debride the pulp chambers could lead to increased failure of the endodontic treatment.[18]

Vieira et al.[33] also reported that although the preservation of dentine remains important in fracture prevention, disinfection was improved in endodontically treated teeth with TAC's when compared to teeth with CAC designs.

When evaluating centering ability and canal transportation between different access cavity design groups in posterior teeth conflicting results were found. Most studies showed no difference in transportation and centering ability[22,32] whilst two studies showed an increased likelihood of transportation in CAC compared to TAC. [19,34] Alovisi et al.[34] showed that TAC resulted in better original canal anatomy preservation than CAC. This was particularly evident in the apical portion of the canals.[2] Rover et al.[19] reported a higher incidence of canal transportation in CAC design groups as well as a reduced ability to locate canals compared to the TAC design groups.

Sabeti et al.[9] investigated the effect of root canal preparation taper in conjunction with different access cavity designs on the fracture resistance of endodontically treated teeth. They found that an

increase in the taper of root canal preparation had a negative effect on the fracture resistance. Elkholy et al.[35] evaluated the impact of root canal taper and access cavity design on the life span of endodontically treated mandibular molars. They concluded that the life span of endodontically treated teeth is affected more by the type of access cavity design than the root canal preparation taper. They further reported that stress patterns were found to migrate more apically rather than concentrate in the pericervical area.[35]

When evaluating microbial reduction and remaining pulpal tissue between TAC and CAC, it seems that most studies found no significant difference between the two endodontic access cavity preparation groups. [19,21,22,36,37] When evaluating canal location, a study by Saygili et al.[38] reported higher incidence of successful MB2 canal location in CAC and TAC designs compared to UCA designs while the authors could not find any literature that favours a specific access cavity design with regards to successful canal location in molars. Literature shows increased preparation times in all the conservative or ultra-conservative access cavity preparations compared to traditional access cavity preparations.[21,32,39] A reduction in preparation time as well as increased amount of remaining gutta percha (in retreatment cases) on canal walls were found in cases with minimally invasive (CAC) compared to more traditional EAC designs (TAC). [40,41]

DISCUSSION

When evaluating the preservation of dentine in molars as the main reason for minimally invasive or conservative access cavities a review study of Shabbir et al.[42] indicated that a few discrepancies exist in the results of these studies. Shabbir et al.[42] mentioned that there is a large variation in definition and extension of the access cavity designs. The authors also noted a lack of proper sample size, standardization and distribution as well as types of study designs used.

They further noted that in some studies access cavities were restored and in others the cavities were left unrestored with fracture resistance tests. This had a significant effect on the outcome of these studies. Shabbir[42] et al. also reported large discrepancies between drawings of different types of access cavities in molars. The authors commented that this “free-hand” approach cannot be standardised due to anatomical variations between teeth and operators. In order to accurately compare these groups it was suggested that teeth should be matched on size and volume using micro-CT analysis.

A study by Corsentino et al.[13] showed that the loss of a marginal ridge may negatively affect fracture resistance more than the access cavity design. Shabbir et al.[42] further suggested in a review article that there is little evidence supporting the fact that minimally invasive access cavities increase fracture resistance. Although fracture resistance and the reduction of stress on pericervical dentine remains the main focus of minimally invasive EAC, secondary aspects should also be taken into consideration when deciding on the preferred access cavity preparation.
These include irrigation efficacy, canal shaping and preparation times, pulp tissue debridement, microbial reduction, centering ability, transportation, non-vital bleaching and obturation space. Although inadequate literature exists on the evaluation of remaining pulp tissue as well as bacterial reduction, literature suggests both of these factors are in some way negatively affected by conservative / ultra-conservative access cavities. Little evidence exists for the beneficial use of these minimally invasive access cavity preparations compared to traditional access cavity preparations.[42]

In a review article by Maqbool et al.[43] the authors also concluded that little evidence is available to suggest CAC or UAC designs aids in the retention of endodontically treated teeth by increasing their fracture resistance. Shabbir et al.[42] concluded that there was an increased risk compared to the benefit in terms of endodontic outcomes, when comparing minimally invasive to traditional access cavity designs. The authors further advise that clinicians should apply minimally invasive access cavities only in selected cases.[42]

CONCLUSION

Literature provides no consensus or conclusive evidence favouring conservative or ultra-conservative molar access cavities above traditional molar access cavities in terms of fracture resistance and post-endodontic treatment. The role of selecting the appropriate post endodontic restoration method as well as material should also be emphasised. Similarly, no conclusive evidence exists on whether conservative or ultra-conservative access cavity designs allow for proper shaping and disinfection or not, or even if these access cavities have any negative effect on the probability of missing canals during endodontic treatment. Conservative/minimally invasive access cavities could also comprise endodontic treatment in terms of debridement, canal location and proper irrigation whilst trying to preserve dentine.

The authors therefor strongly recommend the use of advanced endodontic irrigation protocols, adjunct irrigation devices as well as CBCT and magnification in cases where conservative or minimally invasive endodontic access cavities are considered. The authors further recommend that clinicians should evaluate each case based on preserving dentine, whilst balancing the risks associated with removing too little dentine during access cavity preparation when deciding on the ideal molar access cavity design prior to endodontic treatment. Advanced armamentarium should be implemented and be available when considering conservative or ultra-conservative endodontic access cavities. Traditional endodontic access cavities still remain an accepted treatment modality in cases where the correct armamentarium is unavailable.

REFERENCES

1. Berman LH, Hargreaves KM. Cohen's Pathways of the pulp. Elsevier Health Sciences; 2015.
2. Manigandan K, Ravishankar P, Sridevi K, Keerthi V, Prashanth P, Kumar ARP. Impact of dental operating microscope, selective dentin removal and cone beam computed tomography on detection of second mesiobuccal canal in maxillary molars: A clinical study. Indian J. Dent. Res. 2020;31(4):526.
3. Azim AA, Aksel H, Zhuang T, Mashtare T, Babu JP, Huang GT-J. Efficacy of 4 irrigation protocols

in killing bacteria colonized in dentinal tubules examined by a novel confocal laser scanning microscope analysis. J. Endod. 2016;42(6):928-934.
4. Tzimpoulas NE, Alisafis MG, Tzanetakis GN, Kontakiotis EG. A prospective study of the extraction and retention incidence of endodontically treated teeth with uncertain prognosis after endodontic referral. J. Endod. 2012;38(10):1326-1329.
5. Touré B, Faye B, Kane AW, Lo CM, Niang B, Boucher Y. Analysis of reasons for extraction of endodontically treated teeth: a prospective study. J. Endod. 2011;37(11):1512-1515.
6. Reeh ES, Messer HH, Douglas WH. Reduction in tooth stiffness as a result of endodontic and restorative procedures. J. Endod. 1989;15(11):512-516.
7. Bürklein S, Schäfer E. Minimally invasive endodontics. Quintessence Int. 2015;46(2):119-124.
8. Saberi EA, Pirhaji A, Zabetiyan F. Effects of endodontic access cavity design and thermocycling on fracture strength of endodontically treated teeth. Clinical, Cosmetic and Investigational Dentistry. 2020;12:149.
9. Sabeti M, Kazem M, Dianat O, et al. Impact of access cavity design and root canal taper on fracture resistance of endodontically treated teeth: an ex vivo investigation. J. Endod. 2018;44(9):1402-1406.
10. Al Amri MD, Al-Johany S, Sherfudhin H, et al. Fracture resistance of endodontically treated mandibular first molars with conservative access cavity and different restorative techniques: an in vitro study. Aust. Endod. J. 2016;42(3):124-131.
11. Lang H, Korkmaz Y, Schneider K, Raab W-M. Impact of endodontic treatments on the rigidity of the root. J. Dent. Res. 2006;85(4):364-368.
12. Zhang Y, Liu Y, She Y, Liang Y, Xu F, Fang C. The effect of endodontic access cavities on fracture resistance of first maxillary molars using the extended finite element method. J. Endod. 2019;45(3):316-321.
13. Corsentino G, Pedullà E, Castelli L, et al. Influence of access cavity preparation and remaining tooth substance on fracture strength of endodontically treated teeth. J. Endod. 2018;44(9):1416-1421.
14. Bóveda C, Kishen A. Contracted endodontic cavities: the foundation for less invasive alternatives in the management of apical periodontitis. Endodontic Topics. 2015;33(1):169-186.
15. Tang W, Wu Y, Smales RJ. Identifying and reducing risks for potential fractures in endodontically treated teeth. J. Endod. 2010;36(4):609-617.
16. Clark D, Khademi J. Modern molar endodontic access and directed dentin conservation. Dental Clinics. 2010;54(2):249-273.
17. Özyürek T, Ülker Ö, Demiryürek EÖ, Yılmaz F. The effects of endodontic access cavity preparation design on the fracture strength of Endodontically treated teeth: traditional versus conservative preparation. J. Endod. 2018;44(5):800-805.
18. Neelakantan P, Khan K, Ng GPH, Yip CY, Zhang C, Cheung GSP. Does the orifice-directed dentin conservation access design debride pulp chamber and mesial root canal systems of mandibular molars similar to a traditional access design? J. Endod. 2018;44(2):274-279.
19. Rover G, Belladonna FG, Bortoluzzi EA, De-Deus G, Silva EJNL, Teixeira CS. Influence of access cavity design on root canal detection, instrumentation efficacy, and fracture resistance assessed in maxillary molars. J. Endod. 2017;43(10):1657-1662.
20. Moore B, Verdelis K, Kishen A, Dao T, Friedman S. Impacts of contracted endodontic cavities on instrumentation efficacy and biomechanical responses in maxillary molars. J. Endod. 2016;42(12):1779-1783.
21. Silva A, Belladonna F, Rover G, et al. Does ultraconservative access affect the efficacy of root canal treatment and the fracture resistance of two-rooted maxillary premolars? Int. Endod. J. 2020;53(2):265-275.
22. Barbosa A, Silva E, Coelho B, Ferreira C, Lima C, Sassone L. The influence of endodontic access cavity design on the efficacy of canal instrumentation, microbial reduction, root canal filling and fracture resistance in mandibular molars. Int. Endod. J. 2020;53(12):1666-1679.
23. Saber SM, Hayaty DM, Nawar NN, Kim H-C. The effect of access cavity designs and sizes of root canal preparations on the biomechanical behavior of an endodontically treated mandibular first molar: A finite element analysis. J. Endod. 2020;46(11):1675-1681.
24. Varghese VS, George JV, Mathew S, Nagaraja S, Indiresha H, Madhu K. Cone beam computed tomographic evaluation of two access cavity designs and instrumentation on the thickness of peri-cervical dentin in mandibular anterior teeth. JCD. 2016;19(5):450.
25. Lin C-Y, Lin D, He W-H. Impacts of 3 different endodontic access cavity designs on dentin removal and point of entry in 3-dimensional digital models. J. Endod. 2020;46(4):524-530.
26. Xia J, Wang W, Li Z, et al. Impacts of contracted endodontic cavities compared to traditional endodontic cavities in premolars. BMC Oral Health. 2020;20(1):1-8.
27. Yuan K, Niu C, Xie Q, et al. Comparative evaluation of the impact of minimally invasive preparation vs. conventional straight-line preparation on tooth biomechanics: a finite element analysis. Eur. J. Oral Sci. 2016;124(6):591-596.
28. Chlup Z, Žižka R, Kania J, P-ibyl M. Fracture behaviour of teeth with conventional and mini-invasive access cavity designs. J. Eur. Ceram. 2017;37(14):4423-4429.
29. Krishan R, Paqué F, Ossareh A, Kishen A, Dao T, Friedman S. Impacts of conservative endodontic cavity on root canal instrumentation efficacy and resistance to fracture assessed in incisors, premolars, and molars. J. Endod. 2014;40(8):1160-1166.
30. Plotino G, Grande NM, Isufi A, et al. Fracture strength of endodontically treated teeth with different access cavity designs. J. Endod. 2017;43(6):995-1000.
31. Santosh SS, Ballal S, Natanasabapathy V. Influence of minimally invasive access cavity designs on the fracture resistance of endodontically treated mandibular molars subjected to thermocycling and dynamic loading. J. Endod. 2021;47(9):1496-1500.

32. Augusto C, Barbosa A, Guimaraes C, et al. A laboratory study of the impact of ultraconservative access cavities and minimal root canal tapers on the ability to shape canals in extracted mandibular molars and their fracture resistance. Int. Endod. J. 2020;53(11):1516-1529.
33. Vieira GC, Pérez AR, Alves FR, et al. Impact of contracted endodontic cavities on root canal disinfection and shaping. J. Endod. 2020;46(5):655-661.
34. Alovisi M, Pasqualini D, Musso E, et al. Influence of contracted endodontic access on root canal geometry: an in vitro study. J. Endod. 2018;44(4):614-620.
35. Elkholy MM, Nawar NN, Ha WN, Saber SM, Kim H-C. Impact of canal taper and access cavity design on the lifespan of an endodontically treated mandibualr molar: A finite element analysis. J. Endod. 2021.
36. Rover G, de Lima C, Belladonna F, et al. Influence of minimally invasive endodontic access cavities on root canal shaping and filling ability, pulp chamber cleaning and fracture resistance of extracted human mandibular incisors. Int. Endod. J. 2020;53(11):1530-1539.
37. Tüfenkçi P, Yılmaz K. The effects of different endodontic access cavity design and using XP-endo Finisher on the reduction of Enterococcus faecalis in the root canal system. J. Endod. 2020;46(3):419-424.
38. Saygili G, Uysal B, Omar B, Ertas ET, Ertas H. Evaluation of relationship between endodontic access cavity types and secondary mesiobuccal canal detection. BMC Oral Health. 2018;18(1):1-6.
39. Marchesan MA, Lloyd A, Clement DJ, McFarland JD, Friedman S. Impacts of contracted endodontic cavities on primary root canal curvature parameters in mandibular molars. J. Endod. 2018;44(10):1558-1562.
40. Fatima K, Nair R, Khasnis S, Vallabhaneni S, Patil JD. Efficacy of rotary and reciprocating single-file systems on different access outlines for gutta-percha removal in retreatment: An in vitro study. JCD. 2018;21(4):354.
41. Niemi TK, Marchesan MA, Lloyd A, Seltzer RJ. Effect of instrument design and access outlines on the removal of root canal obturation materials in oval-shaped canals. J. Endod. 2016;42(10):1550-1554.
42. Shabbir J, Zehra T, Najmi N, et al. Access cavity preparations: Classification and literature review of traditional and minimally invasive endodontic access cavity designs. J. Endod. 2021.
43. Maqbool M, Noorani TY, Asif JA, Makandar SD, Jamayet NB. Controversies in endodontic access cavity design: A literature review. Dent. Update. 2020;47(9):747-754.

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In vitro antibacterial activity of three root canal sealers against *Enterococcus Faecalis*

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ABSTRACT

The antibacterial activity of root canal sealers may contribute to the eradication of remaining bacteria in root canals following canal shaping and debridement.

Aim

The aim of the study is to assess the antimicrobial effect of 3 endodontic sealers: Sealapex™, EndoREZ™ and Guttaflow bioseal™ against *Enterococcus faecalis.*

Materials and Methods

This was a laboratory-based comparative study testing the antimicrobial activity of three endodontic sealers against *Enterococcus faecalis*. The endodontic sealers were tested unset 20 minutes after mixing and after setting.

Testing after setting enabled the assessment of the antimicrobial activity of aged sealers after 7, 14, 21 and 28 days. A total of 150 samples were used for the study.

The tested sealers were divided into 3 groups:

- Group 1 (EndoREZ™) n = 45 plates, n = 5 control plates.
- Group 2 (Guttaflow bioseal™) n = 45, n = 5 control plates.
- Group 3 (Sealapex™) n = 45, n = 5 control plates.

Results

All the materials exhibited some activity against the bacteria. The overall greatest antibacterial activity can be seen by Guttaflow bioseal™ (4.46, 0.01) on day 21, followed by Sealapex™ (5.12, 0.05) on day 7 and EndoREZ™ (6.37,0.08) on day 14.

Conclusion

Under the conditions of this study all the endodontic sealers exhibited some antimicrobial activity against *E. faecalis* with different behaviour patterns at different times.

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INTRODUCTION

Endodontic treatment involves the optimum shaping and debridement of the canal system to gain a tapered centred canal ensuring that there is minimal transportation of the apex. This allows for optimal adequate cleaning through irrigation and placement of intracanal dressing.[1]

Complete removal of the microbial population from the root canal system of the tooth remains the overall goal of endodontic treatment.[2] There is evidence, however, that no single method of root canal preparation is capable of completely eradicating the microbial population in root canal systems.[3] Thus, materials used for obturation which have antibacterial properties are advantageous so that any residual microbial population remaining in the root canal system can be destroyed.[4]

Root canal preparation consists of two intimately related procedures namely mechanical preparation and disinfection, which remains an essential component of endodontic treatment. Several methods and instruments have been developed for root canal preparation. Nickel-titanium represents the latest metallurgy in endodontics for hand, rotary and reciprocating files.[5]

While a significant portion of microorganisms in dentine are removed during instrumentation, some areas within the canal remain untouched partly due to the complexity of the root canal system that encompasses lateral canals, fins, anastomoses and ramifications.[5] Accordingly, in one study up to 53% of the canal walls were untouched by instrumentation.[6] Utilizing new instruments like Self Adjusting File (SAF), TRUshape and XP-endo, that can deal with irregular canal anatomy is often advisable. Entombing bacteria in unprepared sites is not reliable and predisposes to poor treatment

outcome.[7] Therefore, it is essential that mechanical preparation shape the canal to facilitate irrigation of the canal.[8]

Irrigants used in endodontics should be able to destroy micro-organisms, neutralize endotoxin and remove organic tissue components.[8] A variety of substances have been used as irrigants including; chlorhexidine, sterilox, sodium hypochlorite, EDTA and QMIX. Sodium hypochlorite possesses ideal antimicrobial properties and is still regarded by the profession as the gold standard irrigant.[9]

The method of action of sodium hypochlorite is related to its high pH which denatures proteins and the hydroxyl ion which destroys the bacterial lipid membrane, DNA amongst other things.[10] On the other hand, the chloride ion is responsible for dissolving proteins through breakage of peptide bonds. Even though a significant number of microorganisms can be eradicated from the canal by irrigants alone or in combination with mechanical procedures, cultivable bacteria has been isolated in canals after root canal preparation before obturation.[11] One such bacterial species isolated following shaping and disinfection of the canals is *Enterococcus faecalis*. Research done by Haapasalo et al.[11] found that 1% sodium hypochlorite could not kill *E. faecalis* in the presence of dentine. In a study by Bystrom and Sundqvist[12], necrotic root canals could not be rendered free of bacteria using different concentrations of sodium hypochlorite and EDTA.[3,12,13]

Following the complete debridement of the root canal system, obturation needs to be completed with non-toxic materials to ensure a full 3D obturation of the root canals.[14] 3D obturation should aim to provide a hermetic 'fluid-tight' seal that prevents reinfection of the canals.[15] A positive correlation has been found between a good root canal seal and a positive outcome of the endodontic treatment.[16] To obtain a hermetic fluid-tight seal, obturation is routinely performed with the combination of a solid core material and an endodontic sealer. Solid gutta percha is usually the core used in endodontic obturation. Different obturation techniques have been advocated although cold lateral and warm vertical compaction are most common.[17] Endodontic infections can broadly be categorized into intra radicular or extra radicular infections.[18] Intra radicular infections are further subdivided into:

- Primary or initial infection results when microorganisms enter and colonize non-vital pulpal tissue.
- Secondary infection is when microorganisms that were not part of the primary infection are then introduced into the canals of the tooth during endodontic treatment.
- Recurrent persistent infection results when the microbial population in the primary or secondary infections resists intracanal procedures and are able to survive in the treated root canal.[19]

Extra radicular infection in turn is a result of the colonization by microbes of the periradicular tissues, which is usually as a consequence of intra radicular infection. Extra radicular infections may be conditional on the intraradicular infection, or it can be completely independent thereof.[19] Initial infections comprise of a multispecies community of bacteria dominated by anaerobes.[20,21] The concentration and amount of bacterial species and cells determine the size of the apical periodontal lesion.[22] During different phases of root canal infection, certain species may dominate over other bacterial species. The change in the microbial population makeup is most likely due to changes in the environmental conditions, especially oxygen tension and the availability of nutrients. Facultative bacteria dominate in the initial infectious stage and as there is depletion of oxygen within the root canal system; obligate anaerobes start increasing.[18,23]

The point of entry for microbes into the pulp is from the typical oral microbial population usually via the extension of a carious lesion from the tooth crown; dentinal tubules are opened enabling access to the bacterial population.[24] The dentino-pulp complex is usually a sterile environment, and invasion with microorganisms only occur when there is a breach. Examples of this may be due to caries, trauma and/or restorative treatment. During endodontic intervention, the potential for entry of microorganisms also exist.[25]

Persistent intra radicular colonization is a result of bacteria that resist cleaning and disinfection of the canal thereby continuing to survive in obturated canals. These bacteria can be the remaining population of primary or secondary infections.[26] Various studies have identified *E. faecalis* as one of the most frequently observed microorganisms in obturated root canals with an incidence of up to 90% of cases.[27,28] In non-vital teeth, bacterial invasion occurs at a swift rate, conceivably due to the absence of host defence mechanism.[28]

Both persistent and secondary infections display various clinical symptoms, including:

- recurrent exudation
- persistent symptoms
- inter-appointment pain and flare-ups
- endodontic treatment failure, which is demonstrated by post treatment apical periodontitis lesion.*19*

Several culture and molecular biology research projects concluded that *E. faecalis* is the most recurrent species in endodontically obturated teeth, with an incidence up to 90% of cases.[12,28,29] *Enterococcus faecalis* in obturated canals can be thought to be a secondary invader capable of colonizing the canal and resisting treatment.[30]

Enterococcus faecalis belongs to the Enterococcus genus, which consist of catalase-negative, gram-positive, non-spore forming, facultative anaerobes. These microorganisms may present as cocci or chains.[31] *Enterococcus faecalis* can survive in very severe conditions like extreme alkaline pH, and salt concentrations. They can propagate in the range 10 – 45 °C.[32]

E faecalis is isolated in 24 to 90 % of the positive cultures.[33,34] This may be due to the microorganism's ability to resist antimicrobial agents as well as the potential to adapt

to a changing environment. This allows proliferation of the organism in the root canal system and may cause reinfection. *Enterococcus faecalis* binds to the dentine of root canals resulting in the formation of dental biofilm. The ecosystem of biofilms assists in resisting destruction by allowing the bacteria to become unaffected by phagocytosis, antibodies and antimicrobial measure. The antimicrobial resistance of this bacteria has been ascribed to the protective barrier provided by the extracellular polymeric matrix.[35] This bacterium penetrates dentinal tubules thus evading mechanical instrumentation and chemical irrigation during endodontic treatment.[19]

Effective endodontic treatment requires a hermetic fluid-tight seal of the tooth, which is achieved by successful and complete obturation.[36] Currently, the known method of endodontic filling involves a solid or semi-solid core such as gutta percha and an endodontic sealer. The core like gutta percha has no sealing ability and antimicrobial activity, therefore, endodontic sealers are required to obtain a hermetic fluid-tight seal in the root canal. This is achieved through obturation of the lateral, accessory canals, voids, spaces and anomalies between gutta-percha and root dentine wall.[37] Some root canal sealers have antibacterial properties and may help to entomb the remaining bacteria after endodontic preparation. Antibacterial activity is one of the prerequisites of an ideal endodontic sealer.[38]

Sealapex™ is a calcium hydroxide based endodontic sealers. It is one of the most studied endodontic sealers.39 The release of hydroxide ions and creation of an alkaline pH is responsible for the antimicrobial activity of Sealapex™. As the setting reacting takes place, the pH decreases and the efficacy of the endodontic sealer decreases.[12,40,41] In a direct contact test (DCT) study, Fuss et al.[41] tested two calcium hydroxide sealers including Sealapex™ and Zinc-oxide eugenol Roth™ cement against E faecalis. Roth™ cement was potent against the bacteria in the 1st hour and at 24 hours of aging while Sealapex™ showed better activity in 7 days of aging. In a study using Agar diffusion test (ADT) and direct contact test (DCT), Sealapex™ was found to have no antibacterial activity when ADT was used; while with the DCT; antimicrobial activity was found after 60 minutes of aging.[42]

A systematic review on calcium hydroxide based endodontic sealers showed conflicting results with some showing antibacterial activity while others showing no antibacterial activity. Therefore, the review noted that there was conflicting evidence regarding calcium hydroxide-based sealers.[39] Regarding Sealapex™ in particular, another systematic review pointed out that there was no difference in antimicrobial efficacy of Sealapex™ and AH- Plus™ against *E. faecalis*. However, the review noted that the evidence was poor due to high risk of bias of the studies considered.[43]

EndoREZ™ is a urethane dimethacrylate resin based endodontic sealer. In a study by Eldeniz et al.[44] using ADT and DCT, EndoREZ™ did not show any antimicrobial activity in 24 hours, 48 hours, 7 days, and 10 days. Later in a similar study Farmakis et al.[45] found similar results as they noted that EndoREZ™ exhibited 0 mm exhibition zone using ADT while no antibacterial effect was also found with DCT. Heyder et al.46 also concluded the same for EndoREZ™. However, in an earlier study EndoREZ™ was found to be bactericidal against *Enterococcus faecalis* at 3 and 7 days after mixing.[47]

Guttaflow bioseal™ is the successor of silicone-based root canal sealers Guttaflow™ and Guttaflow2™. These are derived from polydimethylsiloxane with powdered gutta-percha and microsilver particles.[48] Guttaflow bioseal™ is the latest material of the series which constitutes of polydimethylsiloxane, zirconium dioxide, gutta-percha powder, platinum catalyst, silver (preservative), bioactive glass ceramic and coloring. According to the manufacturer (Coltène/Whaledent, Altstatten, Switzerland); Guttaflow bioseal™ has improved biological properties including antibacterial activity compared to GuttaFlow™ and GuttaFlow 2™.[49]

Earlier studies involving Guttaflow™ and Guttaflow 2™ have indicated a lack of antibacterial activity. In a study comparing the antimicrobial activity against *E. faecalis* of Epiphany™, Guttaflow™ and AH-Plus™ endodontic sealers after 1- and 24-hours using ADT and DCT, Guttaflow™ was found to lack antimicrobial activity.[50]

However, a study by Anumula et al.[51] showed slight antibacterial activity of Gutta Flow™ for the first 3 hours after mixing which reduced drastically. In a recent study RoekoSeal™, Guttaflow 2™, TotalFill BC™ sealer, AH Plus™ were tested against planktonic and 24-hour old *Enterococcus faecalis* biofilms. The authors concluded that RoekoSeal™ and Guttaflow 2™ had no antibacterial activity against *E. faecalis* in both forms.[48]

A recent study using Guttaflow 2™, found that it had no antimicrobial activity against *E. faecalis* using both ADT and DCT testing methods.[52] Studies involving Guttaflow bioseal™ and *E. faecalis* are still very few due to its recent introduction in the market. However, in a recent study it was found that the antibacterial efficiency of Guttaflow Bioseal™ improved up to 4 weeks after placement. The calcium silicate particles in Guttaflow Bioseal™ are thought to provide an alkaline environment after setting through release of calcium ions and this results in antimicrobial activity.[49]

MATERIALS AND METHODS

A laboratory-based comparative study was conducted by testing the antimicrobial activity of three commonly used endodontic sealers against *Enterococcus faecalis*. The endodontic sealers were tested unset 20 minutes after mixing and after setting. Testing after setting enabled the assessment of the antimicrobial activity of aged sealers after 7 days, 14 days, 21 days and 28 days. A total of 150 samples were used for the study.

Sample size:

The tested sealers were divided into 3 groups:

Fig 1: Comparison of antibacterial activity of sealers per day

Group 1 (EndoREZ™) n = 45 plates, n = 5 control plates.
Group 2 (Guttaflow bioseal™) n = 45, n = 5 control plates.
Group 3 (Sealapex™) n = 45, n = 5 control plates.

Microorganism:

Enterococcus faecalis, American Type Cell Culture Collection (ATCC) 19434 was used as a test organism. The bacteria were cultured in air at 37° C on Tryptic Soy Agar plates for the experiments. For each experiment a 24-hour culture was used. A suspension of bacteria in phosphate-buffered saline (PBS) was made and adjusted to 0.5 McFarland scale equivalent to 1.5 x 10^8 CFU.

Endodontic Sealers:

Three sealers were used for the study. Sealapex™ (Kerr), EndoRez™ (Ultradent, South Jordan, UT) and Roeko Guttaflow Bioseal™ (Coltene/ Whaledent, Switzerland). All sealers were prepared according to manufacturers' guidelines. A 96-well microtiter plate was held perpendicular to the floor, and an area on the side wall of the wells was coated with an equal amount of each material. The sealers tested at day 0 (20 minutes after mixing) were regarded as fresh specimens while other specimens were allowed to set for 7,14,21 and 28 days in a humid atmosphere at 37 °C before testing.

A 250µl bacterial suspension was placed in contact with each sealer. The bacterial solution placed in the uncoated wells served as the control. The incubation was done in 100% humidity at 37 °C for 2, 5, 20, and 60 minutes. After gently agitating with a pipette for 30 seconds, the bacterial suspension from each well was transferred and serially diluted in Phosphate Buffered Saline (PBS).

The evaluation of the DCT was assessed by culturing aliquots of 100 µL onto TSA plates after 10-fold serial dilutions. After incubation for 24 hours at 37°C, colonies on the plates were counted, and the CFU/mL was calculated.

Direct contact test (DCT)

The Direct Contact Test method represents another way of assessing the antibacterial effect of endodontic sealers. This method of investigation was first introduced by Weiss et al.[53] for the assessment of the antibacterial effect of root canal sealers and root-end filling materials.

Due to limitations of ADT, many studies advocate using the Direct Contact Test method. This method involves testing the antibacterial activity of the root canal sealer when there is a direct connection between the material under investigation and the specific bacterial organism. This method is able to measure antimicrobial activity, independent of whether the material is soluble or can diffuse through the medium. This is a quantitative and reproducible assay which allows for the investigation of insoluble materials resulting in a standardized assay. Thus, this method produces reliable results.[53]

Two methods of evaluating the results of the DCT have been used extensively in endodontic literature. Traditionally, colony forming units (CFU/ml) has been used to assess the results of the DCT, while recently the

Table I: Log CFU mean and SD of EndoREZ™, Guttaflow bioseal™ and Sealapex™						
Summary of Log CFU/ml						
	EndoREZ™		Guttaflow™		Sealapex™	
DAY	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n
0	8.30 (0.15)	9	7.39 (0.07)	9	7.22 (0.15)	9
7	7.20 (0.17)	9	6.32 (0.10)	9	5.12 (0.05)	9
14	6.37 (0.08)	8	5.42 (0.06)	9	6.40 (0.04)	9
21	7.32 (0.09)	8	4.46 (0.01)	8	7.43 (0.02)	9
28	8.44 (0.02)	9	8.38 (0.10)	8	7.46 (0.01)	9
Total	7.56 (0.78)	43	6.39 (1.37)	43	6.73 (0.90)	45

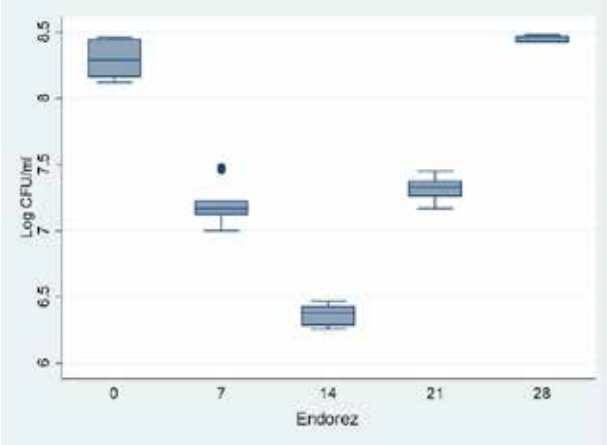

Fig 2: Activity of EndoREZ™.

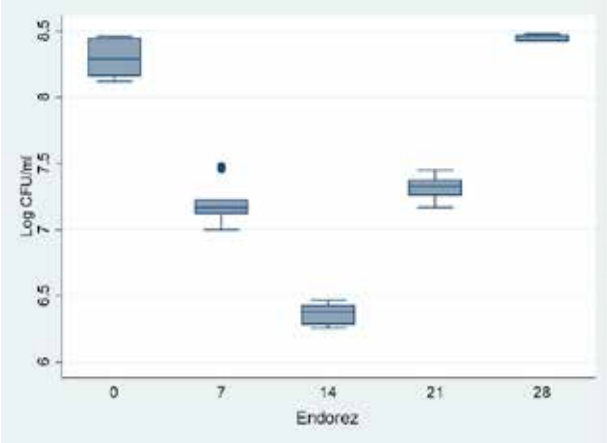

Fig 3: Activity of Guttaflow bioseal™.

Statistical analysis

All data was described with the mean and standard deviation. A one-way mixed measures ANOVA test with Bonferroni correction was used to determine statistical significance between the three materials. All tests were deemed statistically significant at $p < 0.05$. All tests were conducted in Stata Corp.2017. Stata Statistical Software Release 15. College Station, TX: StataCorp LLC

RESULTS & STATISTICAL ANALYSIS

Overview of results

All the materials exhibit some activity against E Faecalis and are presented as mean (SD). Guttaflow bioseal™ exhibited the overall greatest antibacterial activity, 4.46 (0.01) on day 21, followed by Sealapex™, 5.12; (0.05) on day seven and EndoREZ™, 6.37 (0.08) on day 14 (Figure 1). Between the materials investigated there was a difference in antibacterial activity over a period of time, where Guttaflow bioseal™ vs EndoREZ™ had the biggest difference, -1.12 (0.14) followed by Sealapex™ vs EndoREZ™, -0.805 (0.14). Guttaflow bioseal™ and Sealapex™ did not show much difference in activity, 0.32 (0.14).

Antibacterial activity of EndoREZ™

The highest Log CFU count was 8.44 (0.02) at day 28 for EndoREZ™ (Table I, Figure 2). The second highest Log CFU count was at day 0, 8.30 (0.15). However, the difference between the activity on day zero and day 28 is not statistically significant ($p = 0.124$). The activity of EndoREZ™ gradually increases to reach its highest on day 14, 6.37 (0.08). After that, the activity gradually reduces to reach the highest Log CFU/ml on day 28.

Antibacterial activity of Guttaflow bioseal™

The activity of Guttaflow bioseal™ increases from fresh samples to reach the maximum bactericidal activity on day 21, 4.46 (0.01) as shown by the lowest log CFU/ml (Table I, Figure 3). After day 21, the activity reduced dramatically, 8.38 (0.10). The activity on day 28, 8.38 (0.10) was much less than the activity at day zero, 7.39 (0.07), $p < 0.001$. The difference between day 28 and day zero for Guttaflow was 0.974 (95% CI: 0.817 to 1.142).

Antibacterial activity of Sealapex™

The activity of Sealapex™ increased and reached its peak on day seven, 5.12 (0.05), thereafter its potency dissipates, 6.40 (0.04) on day14 (Table I, Figure 4). On day 21 and 28 there is no difference in the activity of Sealapex as shown by the CI (-0.116 to 0.187), $p = 1.00$. On comparing day 28 and day 0, there is a difference in the activity (CI 0.095 to 0.398) with day 28 sample being less potent, $p < 0.001$.

DISCUSSION

The goal of endodontic obturation is to achieve a permanent fluid tight hermetic seal of the pulp chamber and roots of the tooth in order to eliminate the risks of infection or reinfection of the root canal system. A sealer is usually employed to obtain a hermetic seal. Often failure of endodontic treatment is due to the spaces within the root canal system as a result of not being

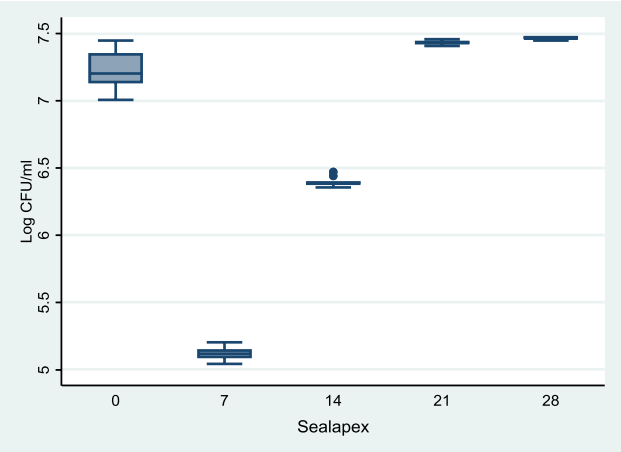

Fig 4: Activity of Sealapex™.

obturated properly. The interaction between the oral environment and root canal spaces as well as residual bacteria in canals (from inadequate debridement) may contribute to endodontic treatment failure. Thus, antibacterial activity of root canal sealers contributes to the success of endodontic treatment.

The antibacterial effect of root canal sealers may assist with the eradication of the remaining microbial organisms after root canal shaping and cleaning as it has been shown in previous studies that no root canal preparation technique is capable of eliminating all the microorganisms from the root canal system.[47] Many root canal sealers have claimed to be antimicrobial against the common endodontic microorganisms. *Enterococcus faecalis* was the selected test microorganism in this study due to its high prevalence of isolation in cases of persistent apical periodontitis even after root canal treatment.55 *E. faecalis* is known to survive, grow within dentinal tubules and reinfect canals.[56]

Bacterial survival in root canals may be ascribed to their ability to penetrate the dentinal tubules where biofilm formation can take place. This protects these microorganisms from disinfecting agents cleaning the root canal system. Other authors advocate that *Enterococcus faecalis* in obturated teeth with post-treatment disease continues being viable as it adheres to collagen in the presence of human serum and form resistant biofilms.[57]

In this study the Direct Contact Test (DCT) was used, a method pioneered by Weiss et al.[53] to evaluate the antimicrobial activity of endodontic sealers. The DCT evaluates the efficacy of direct and close contact between the material and the tested bacteria on microbial viability. Therefore, it enables measurement of whether the bacteria are viable regardless of the solubility and diffusibilty of the sealer's antibacterial mechanism.[39] Standardization of root canal sealers antimicrobial testing protocols is lacking in literature. The DCT is a quantitative method which can be replicated to evaluate bacterial growth.

Sealapex™ is a calcium hydroxide based endodontic sealer. In this study fresh samples of Sealapex™ at day 0 have a weak activity against *E. faecalis*. This is similar to the study by Fuss et al.[41] A study by Poggio et al.[42] noted that fresh samples of Sealapex did not have any activity against *E. faecalis*. It is important to note that in the study by Poggio et al.[42] the fresh samples were tested after 6 minutes. The antibacterial activity of Sealapex™ is derived from the release of OH ions. The study by Fuss et al.[41] noted that fresh samples of Sealapex™ do not release OH ions in high concentrations hence explaining the weak activity against *E. faecalis* of these samples.[41,42]

Regarding aged samples, in this study the activity of Sealapex™ increased to reach the maximum on day 7, there after the activity started to decrease. This is in agreement with earlier studies which also recorded maximum activity of Sealapex™ on day 7.41,42,47 Most studies limit the evaluation time to 7 days, whereas in the current study the activity of Sealapex™ was evaluated for 28 days. The reduced activity of Sealapex™ after day 7 may be explained by the reduced concentration of the hydroxide ions which are vital for antimicrobial activity. Fuss et al.[41] noted that the set material had a limited amount of the availability of the hydroxide ions.

Earlier on Bystrom and Sundqvist[12] postulated that for a calcium hydroxide sealer to maintain antimicrobial effectiveness the pH must be around 12.5, a position which was also advocated by Mickel et al.[40] As the material sets the pH drops to around 9 causing it to lose its effectiveness.[12,40,41] A recent systematic review noted that there is loss of antibacterial activity against *Enterococcus faecalis* in calcium hydroxide sealers that were allowed to age. However, the evidence provided by the review is conflicting and may be due to the difference in methodologies of studies and time frames.[39]

EndoREZ™ is a methacrylate sealer which sets by chemical cure or light cure and can penetrate dentinal tubules. The fresh samples of EndoREZ™ showed weak antimicrobial activity against *E. faecalis*. The result agrees with the study by Eldeniz et al.[44] which showed mild to no antibacterial activity for fresh samples though they used ADT in their study as opposed to the present study which used DCT. However, there is a contrast to the study by Zhang et al.47which recorded an efficient killing of *E. faecalis* using the DCT method.[44,47]

For aged samples of EndoREZ™ in this study, the antimicrobial activity increased to reach the peak on day 14, thereafter the material started to lose its activity against *E. faecalis*. The antimicrobial effect of EndoREZ™ is thought to occur as a result of the inhibitory effect of the oxygen layer limiting the setting reaction of EndoREZ™. This results in a greater quantity of non-reacted monomers killing *E. faecalis*.[45]

This may help to explain the weak activity of EndoREZ™ at day 21 and 28 as the material was fully set so there were no free monomers to exert the antibacterial activity against *E. faecalis*. Heyder et al.46 in their study noted that the antibacterial activity of EndoREZ™ was inferior to that of Zinc-oxide eugenol sealers and Sealapex™. This is in agreement with the present study which noted that the activity of

EndoREZ™ was weaker than that of Sealapex™ and Guttaflow Bioseal™.

Guttaflow Bioseal™ is a recent addition to the market of the silicone based polymethyl hydrogen siloxane endodontic sealers.[48,50] It is a successor to Guttaflow™ and Guttaflow 2™ and the manufacturer claims it has improved biological properties (Ruiz-Linares et al. 2019). Previous studies using either Guttaflow™ or Guttaflow 2™ showed that both materials had no activity against *E. faecalis* in fresh and aged samples.[48,50,51] In this study the fresh samples had a weak antimicrobial activity against *E. faecalis*. Due to the recent introduction of Guttaflow bioseal™ studies investigating its antimicrobial activity are few.

In this study, the aging of Guttaflow bioseal™ resulted in increased antibacterial activity against *Enterococcus faecalis* reaching its peak on day 21 followed by sharp reduction of antimicrobial activity on day 28. This result partly agrees with the study by Ruiz- Linares et al.[49] which showed increased antimicrobial activity with respect to the control as the material ages. In that study the assessment of antimicrobial activity was performed after day 1, 1 week and 4 weeks. In contrast to their results, the present study showed a marked decrease in the antimicrobial activity against *E. faecalis* on day 28. This can be attributed to the difference in methods of counting viable cells of *E. faecalis* after the DCT. The present study used CFU/ml (colony forming units); while the Ruiz-Linares et al.[49] study used RLUs (relative luminescence intensities). Guttaflow bioseal™ is composed of a mixture of polydimethylsiloxane, platinum catalyzer, calcium silicate, gutta-percha powder and zirconium dioxide.

It is postulated that the calcium silicate particles are responsible for providing an alkaline environment through constant release of calcium ions after setting. This high pH environment is responsible for the antimicrobial properties.[58] Guttaflow bioseal™ is a promising material in endodontics since its antimicrobial activity increases after setting, however further research is needed on this material.

CONCLUSION

It is clear from the study that all the endodontic sealers exhibited some antimicrobial activity against *E. faecalis* with different behaviour patterns at different times. Based on the results of this study Guttaflow Bioseal™ exhibited the greatest antibacterial activity on day 21, followed by Sealapex™ on day 7 and EndoREZ™ on day 14.

REFERENCES

1. Torabinejad M., Walton RE. Endodontics: Principles and Practice, 4th ed. St. Louis: Saunders, 2009: 264-265.
2. Hasheminia M, Razavian H, Mosleh H, Shakerian B. In vitro evaluation of the antibacterial activity of five sealers used in root canal therapy. J. Dent. R. 2017; 14(1):62.
3. Dalton BC, Ørstavik D, Phillips C, Pettiette M, Trope M. Bacterial reduction with nickel-titanium rotary instrumentation. J. Endod. 1998; 24(11):763-7.
4. Wainstein M, Morgental RD, Waltrick SB, Oliveira SD, Vier-Pelisser FV, Figueiredo JA, Steier L, Tavares CO, Scarparo RK. In vitro antibacterial activity of a silicone-based endodontic sealer and two conventional sealers. Braz oral research. 2016; 30(1).
5. Darcey J, Taylor C, Roudsari RV, Jawad S, Hunter M. Modern endodontic principles part 3: preparation. Dent. Update. 2015; 42(9):810-22.
6. Peters OA, Laib A, Göhring TN, Barbakow F. Changes in root canal geometry after preparation assessed by high-resolution computed tomography. J. Endod. 2001; 27(1):1-6.
7. Siqueira Junior JF, Rôças ID, Marceliano-Alves MF, Pérez AR, Ricucci D. Unprepared root canal surface areas: causes, clinical implications, and therapeutic strategies. Braz. oral res. 2018; 32(65): 1-7
8. Hübscher W, Barbakow F, Peters OA. RootŞ canal preparation with FlexMaster: canal shapes analysed by micro-computed tomography. Int Endod J. 2003; 36(11):740-7.
9. Holliday R, Alani A. Traditional and contemporary techniques for optimizing root canal irrigation. Dent Update. 2014; 41(1):51-61.
10. Darcey J, Jawad S, Taylor C, Roudsari RV, Hunter M. Modern endodontic principles part 4: irrigation. Dent Update. 2016; 43(1):20-33.
11. Haapasalo M. Current advances in irrigation. Endod Topics. 2013; 1(27):1-2.
12. Byström A, Sundqvist G. Bacteriologic evaluation of the effect of 0.5 percent sodium hypochlorite in endodontic therapy. Oral Surg, Oral Med, Oral Path, Oral Radiol. 1983; 55(3):307-12.
13. Rôças IN, Siqueira Jr JF, Santos KR. Association of *Enterococcus faecalis* with different forms of periradicular diseases. J Endod. 2004; 30(5):315-20.
14. Kokorikos I, Kolokouris I, Economides N, Gogos C, Helvatjoglu-Antoniades M. Long-term Evaluation of the Sealing Ability of Two Root Canal Sealers in Combination with Self-etching Bonding Agents. J Adhes Dent. 2009; 11(3).
15. Darcey J, Roudsari RV, Jawad S, Taylor C, Hunter M. Modern endodontic principles part 5: obturation. Dent Update. 2016; 43(2):114-29.
16. Ng YL, Mann V, Rahbaran S, Lewsey J, Gulabivala K. Outcome of primary root canal treatment: systematic review of the literature–Part 2. Influence of clinical factors. Int Endod J. 2008; 41(1):6-31.
17. Khalil I, Naaman A, Camilleri J. Properties of tricalcium silicate sealers. J Endod. 2016; 42(10):1529-35.
18. Sakamoto M, Rôças IN, Siqueira Jr JF, Benno Y. Molecular analysis of bacteria in asymptomatic and symptomatic endodontic infections. Oral Microbiol Immunol. 2006; 21(2):112-22.
19. Siqueira JF, Rocas IN. Microbiology of Endodontic Infections. In: Berman LH, Hargraves

KM, Rotstein I. 11th ed. Cohen's Pathways of the Pulp 2016 Missouri: Elsevier 599-629.
20. Blome B, Braun A, Sobarzo V, Jepsen S. Molecular identification and quantification of bacteria from endodontic infections using real-time pol ymerase chain reaction. Oral Microbiol Immunol. 2008, 23(5):384-90.
21. Sundqvist, G. Endodontic microbiology. In Spangberg LSW, editors: Experimental endodontics, Boca Raton, CRC Press 1989; p 131.
22. Vianna ME, Horz HP, Gomes BP, Conrads G. In vivo evaluation of microbial reduction after chemo-mechanical preparation of human root canals containing necrotic pulp tissue. Int Endod J. 2006; 39(6):484-92.
23. Gomes BPFA, Herrera DR. Etiologic role of root canal infection in apical periodontitis and its relationship with clinical symptomatology. Braz. Oral Res. 2018; 32(69):82-110
24. Baumgartner JC, Falkler W. Bacteria in the apical 5mm of infected root canals. J Endod. 1991; 17(8) 380-383.
25. Sjögren U, Figdor D, Persson S, Sundqvist G. Influence of infection at the time of root filling on the outcome of endodontic treatment of teeth with apical periodontitis. Int Endod J. 1997; (30), 297-306.
26. Waltimo T, Trope M, Haapasalo M, Ørstavik D. Clinical efficacy of treatment procedures in endodontic infection control and one-year follow-up of periapical healing. J Endod. 2005; (31) 863-865.
27. Sedgley C, Nagel A., Dahlen G, Reit C, Molander A. Real-time quantitative polymerase chain reaction and culture analyses of *Enterococcus faecalis* in root canals, J Endod. 2006 (32)173-177.
28. Pinheiro ET, Gomes BPFA, Ferraz CCR, Sousa ELR., Teixeira FB, Souza-Filho FJ. Microorganisms from canals of root filled teeth with periapical lesions. Int Endod J. 2003; 36(1):1-11.
29. Molander A, Reit C, Dahlen G. The antimicrobial effect of calcium hydroxide in root canals pretreated with 5% iodine potassium iodide. Dent. Traumatol. 1999; 15(5):205-9.
30. Siren, EK, Haapasalo MP, Ranta K, Salmi P, Kerosuo EN. Microbiological findings and clinical treatment procedures in endodontic cases selected for microbiological investigation. Int Endod J. 1997; 30(2): 91-95.
31. John G, Kumar KP, Gopal SS, Kumari S, Reddy BK. *Enterococcus faecalis*, a nightmare to endodontist: A systematic review. Afr J of Microbiol R. 2015; 9(13):898-908.
32. Flahaut S, Hartke A, Giard JC, Benachour A, Boutibonnes P, Auffray Y. Relationship between stress response towards bile salts, acid and heat treatment in *Enterococcus faecalis*. FEMS Microbiol Lett. 1996; 138(1):49-54.
33. Bhardwaj SB. Role of Enterococci faecalis in failure of Endodontic treatment. Int J Curr Microbiol App Sci. 2013; 2(8):272-7.
34. Sundqvist G, Figdor D, Persson S, Sjögren U. Microbiologic analysis of teeth with failed endodontic treatment and the outcome of conservative re-treatment. Oral Surg, Oral Med, Oral Path, Oral Radiol and Endod. 1998; 85(1):86-93.
35. Mallick R, Mohanty S, Behera S, Sarangi P, Nanda S, Satapathy SK. *Enterococcus faecalis*: A resistant microbe in endodontics. Int J Contemp Dent Med Rev. 2014
36. Ingle JI, Simon JH, Machtou P, Bogaerts P. Outcome of endodontic treatment and re-treatment. Endodontics. 2002; (5)747-68.
37. Khandelwal D, Ballal NV. Recent advances in root canal sealers. Int J of Clin Dent. 2016; 9(3).
38. Mali R, Narangan RS, Dhamali D, Singh A, Thakur A, Patil A. Effect of placement techniques on sealing ability of root canal sealers. Int J oral Care Res. 2016; (4):201-203
39. AlShwaimi E, Bogari D, Ajaj R, Al-Shahrani S, Almas K, Majeed A. In vitro antimicrobial effectiveness of root canal sealers against *enterococcus faecalis*: A Systematic Review. J Endod. 2016; 42(11):1588-97.
40. Mickel AK, Nguyen TH, Chogle S. Antimicrobial activity of endodontic sealers on *Enterococcus faecalis*. J Endod. 2003; 29(4):257-8.
41. Fuss Z, Weiss EI, Shalhav M. Antibacterial activity of calcium hydroxide-containing endodontic sealers on *Enterococcus faecalis* in vitro. Int Endod J. 1997; 30(6):397-402.
42. Poggio C, Trovati F, Ceci M, Colombo M, Pietrocola G. Antibacterial activity of different root canal sealers against *Enterococcus faecalis*. J Clin Exp Dent. 2017; 9(6): e743.
43. Parolia A, Nikolopoulou D, Lim BS, Kanagasingam S. Comparison of antibacterial effectiveness between Sealapex and AH-plus sealer against *Enterococcus faecalis*: a systematic review of in vitro studies. G Ital Endod. 2020; 34(2).
44. Eldeniz AU, Erdemir A, Hadimli HH, Belli S, Erganis O. Assessment of antibacterial activity of EndoREZ. Oral Surg, Oral Med, Oral Path Oral Radiol. 2006; 102(1):119-26.
45. Farmakis ET, Kontakiotis EG, Tselenis-Kotsovili A, Tsatsas VG. Comparative in vitro antibacterial activity of six root canal sealers against *Enterococcus faecalis* and Proteus vulgaris. J Investig Clin Dent. 2012; 3(4):271-5.
46. Heyder M, Kranz S, Völpel A, Pfister W, Watts DC, Jandt KD, Sigusch BW. Antibacterial effect of different root canal sealers on three bacterial species. Dent Mater. 2013; 29(5):542-9.
47. Zhang H, Shen Y, Ruse ND, Haapasalo M. Antibacterial activity of endodontic sealers by modified direct contact test against *Enterococcus faecalis*. J Endod. 2009; 35(7):1051-5.
48. Kapralos V, Koutroulis A, Ørstavik D, Sunde PT, Rukke HV. Antibacterial activity of endodontic sealers against planktonic bacteria and bacteria in biofilms. J Endod. 2018; 44(1):149-54.
49. Ruiz-Linares M, Baca P, Arias-Moliz MT, Ternero FJ, Rodríguez J, Ferrer-Luque CM. Antibacterial and

antibiofilm activity over time of GuttaFlow Bioseal and AH Plus. Dent Mater.J 2019; 38(5):701-6.
50. 50. Nawal RR, Parande M, Sehgal R, Naik A, Rao NR. A comparative evaluation of antimicrobial efficacy and flow properties for Epiphany, Guttaflow and AH-Plus sealer. Int Endod J. 2011; 44(4):307-13.
51. Anumula L, Kumar S, Kumar VS, Sekhar C, Krishna M, Pathapati RM, Venkata Sarath P, Vadaganadam Y, Manne RK, Mudlapudi S. An assessment of antibacterial activity of four endodontic sealers on *Enterococcus faecalis* by a direct contact test: an in vitro study. ISRN Dent 2012
52. Huang Y, Li X, Mandal P, Wu Y, Liu L, Gui H, Liu J. The in vitro antimicrobial activities of four endodontic sealers. BMC Oral Health. 2019; 19(1):1-7.
53. Weiss EI, Shalhav M, Fuss Z. Assessment of antibacterial activity of endodontic sealers by a direct contact test. Dent Traumatol. 1996; 12(4):179-84.
54. Baer J, Maki JS. In vitro evaluation of the antimicrobial effect of three endodontic sealers mixed with amoxicillin. J Endod. 2010; 36(7):1170-3.
55. Siqueira Jr JF. Aetiology of root canal treatment failure: why wel-treated teeth can fail. Int Endod J. 2001; 34(1):1-0.
56. Love RM. *Enterococcus faecalis*–a mechanism for its role in endodontic failure. Int Endod J 2001; 34(5):399-405.
57. Van der Vyver PJ, Botha FS, De Wet FA. Antimicrobial efficacy of nine different root canal irrigation solutions. SADJ. 2014; 69(4):158-65.
58. Gandolfi MG, Siboni F, Prati C. Properties of a novel polysiloxane-guttapercha calcium silicate-bioglass-containing root canal sealer. Dent Mater. 2016; 32(5):113-26.

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Pre-empting and preventing iatrogenic oral trauma: A case report

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ABSTRACT

In keeping with the principles of autonomy, beneficence, and non-maleficence, no dental treatment should be commenced prior to carrying out all the requisite preparatory stages. This includes a thorough initial assessment, establishing an accurate diagnosis, drawing up a list of possible treatment options, presenting these to the patient, and allowing them to make an autonomous and educated decision. This should be followed with the formulation of a structured and carefully considered treatment plan.This case illustrates a case of iatrogenically induced damage suffered by a patient where unplanned treatment was carried out with no consideration of the possible immediate, short term or long terms outcomes. It stresses the need for dentists to consider and pre-empt the consequences of their treatment (or lack there-of) and formulate the best possible plan for each patient. It also needs to be stressed that the proposed management plan must be informed by the principle of 'shared decision making' wherein the patient assumes part of the responsibility and accountability in the decisions taken. The ultimate aim of any plan must be to promote the best possible outcome for the patient (beneficence), and as far as possible prevent iatrogenically induced harm (non-maleficence).

Introduction

Dental treatment should not merely be structured to address the patient's immediate oral condition, but must also take a holistic approach and consider their future functional needs. With the exception of emergency procedures and immediate pain relief, no work should be commenced until the clinician has had the time to conduct a thorough clinical assessment and examination, and draw up a comprehensive, individually focused treatment plan[1]. This should include both immediate, short term and long term actions and objectives. Where possible the dentist should also try to pre-empt and prevent any discomfort, lack of function, psychosocial handicaps, and additional trauma during active therapy and after completion. This may entail provision of one or more interim prostheses that can function to prevent trauma to underlying sensitive structures, aid speech and mastication and serve as diagnostic aids for the definitive restorations [2]. The following case report illustrates the importance of diagnosing a patient's presenting condition, determining their long-term dental plan, and simultaneously considering their interim status while awaiting healing and during active therapy.

Case Report

A 69 year old patient presented with seven remaining maxillary teeth (12, 11, 21, 22, 23, 24 and 25). These were all carious, chipped and slightly mobile. She had been wearing a maxillary metal based partial denture, which was now loose and ill fitting due to the fact that the 16, 17, 27 and 37 had been extracted a few months earlier. The opposing arch was edentulous posteriorly with severe attrition on the remaining anterior teeth (33 to 43). Oral hygiene status was poor, with all of the teeth having evident plaque deposits bucally, lingually and interdentally. There was a slight clicking in her left temporomandibular joint but no pain, deviation or limitation on opening were noted.

Her medical history revealed her to have high blood pressure for which she was receiving medication, as well as epilepsy, which she controlled with Epilem tablets (sodium valproate, 500mg taken daily). She also reported to suffer from anxiety and tension and was aware that she clenched and bruxed her teeth. This was evident from the worn down incisal edges and many chipped and sharp edges of her teeth. She had no allergies or any other systemic conditions of signifance. She was advised to have the remaining maxillary teeth extracted and an immediate maxillary complete denture opposing a mandibular Kennedy Class I denture fabricated.

Due to the sensitivity in the 12, and tongue irritation from the chipped edges, the patient requested that if she was to lose her remaining maxillary teeth, the extractions be done immediately, and to then have the

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dentures made after healing. Extractions were carried out that same day and due to the relative ease and lack of complications, no sutures or antibiotic coverage was deemed necessary. The patient returned a week later in severe pain. Intra-oral examination revealed severely traumatised and inflamed anterior maxillary ridge, poor healing of the sockets, pus exudates, and apparent dry sockets in the 21, 22, and 23 region (Figure 1).

Figure 1. One week post extraction showing severely traumatised anterior maxillary ridge

It was evident that the patient had previously been chewing on her remaining anterior teeth and had continued to do so post extraction. This had led to the mandibular teeth now biting into the recent extraction sockets and causing considerable trauma to the ridge. The poor oral hygiene status of these teeth was no doubt a co-contributor to the resulting damage and infection.

Figure 2. Patient in overclosed occlusion with mandibular teeth biting into the edentulous maxillary ridge

Before any further treatment could be contemplated the sockets needed to be debrided and the tissues given time to heal. However the latter was not be possible if it was constantly being damaged and aggravated by her mandibular teeth. The dentist needed to devise some means of protection and shielding of the anterior maxilla until a denture could be fabricated.

The remaining teeth were scaled and polished and an impression was taken of the mandibular ridge. The cast was poured and a silicone mouth guard was made (Pro form mouth guard laminates, Keystone industries) which covered he remaining teeth and residual ridge. It was then further built up in the posterior edentulous areas with additional silicone creating 2 occlusal masticatory surfaces (Figure 3). The mouth guard was fitted into her mouth and adjusted until it was thick enough to allow her posterior maxillary ridges to come into contact with the rims while at the same time keeping the anterior mandibular teeth from biting into the anterior maxillary alveolar ridge. It was further reduced to ensure acceptable lip closure and patient comfort (Figure 4). All adjustments were made using visual assessment, aided by articulating paper and patient feedback.

Figure 3. Mouthguard fabricated on mandibular cast

Figure 4. Mouthguard in the mouth with posterior blocks preventing contact with the anterior maxilla

Figure 5. Healing of the anterior maxillary sockets after 4 weeks

Figure 6. Improved oral hygiene of the mandibular teeth

The patient was monitored for the next 4 weeks to assess the healing of the maxillary sockets, and ensure she maintained good hygiene prior to fabricating her definitive prostheses (Figures 5 and 6).

The patient was then provided with a new complete maxillary denture opposing a Kennedy Class I distal extension mandibular denture (Figures 7 and 8).

Figure 7. Final mandibular denture fitted

DISCUSSION

The long-term goal of comprehensive dental treatment should be the elimination of disease, creation of a healthy hard and soft tissue environment, provision of stable occlusion and function, and establishment of the best possible aesthetics (within reason)[3]. In order to achieve these goals, any intervention or treatment should be based on an accurate diagnosis followed by considered and well-structured treatment plan. The overarching proposal should not only focus on the tooth level, but must encompass a short, medium and long-term strategy that involves "treating the teeth within the context of the rest of the dentition, the masticatory system and the individual"[4]. It should also be holistic in nature, follow a predetermined plan, and be based on sound knowledge, communication, clinical skills, experience, current evidence and common sense[4].

Figure 8. Healing at delivery appointment (8 weeks post extractions)

The following four steps are generally involved:

1. **Collecting and collating relevant information.** This is obtained from the patient's history, their main complaints, the clinical examination, identification of coexistent diseases and conditions, and assessment of their attitude and desires. At this stage the clinician may be able to arrive at a tentative diagnosis, be aware of any systemic factors that could impact on the treatment or precautions that need to be taken, and have an idea about suitable treatment options[4].
2. **Establishing a diagnosis.** An initial diagnosis may be possible based on the data collected, but the definitive plan often requires further specific investigations.
3. **Consideration of treatment options.** The mouth must be considered holistically including analysis of the dentition, periodontium, soft tissues, temporomandibular joints, occlusion, habits, oral hygiene and other possible confounding influences. The clinician needs to list and assess all options. These are generally based on dentist, patient, and oral factors. The former include their level of knowledge on current evidence based principles and best practice, clinical ability and available resources. Good clinical practice is based on academic knowledge, clinical competence, effective communication and ethical engagement [2]. Patient related factors include the dentist: patient relationship, their desires and attitudes, their age, time and financial status, their ability to tolerate and maintain complex treatment, and anticipated oral hygiene practices. Dental considerations are the current oral hygiene status, degree of dental caries, tooth wear, periodontal disease, pulpal and endodontic status, functional occlusion, and appearance[4].
4. **Formulation of the treatment plan (with options)** The most appropriate treatment plan should be selected in order to "provide a masticatory system that is functionally adequate, free from disease and discomfort, aesthetically pleasing and acceptable to the patient"[3].

The proposed plan should follow a logical progression that is convenient, appropriate and as stress-free as possible to both the clinician and patient. It should also make effective use of clinical time, provide the patient with sufficient information on issues such as time-frames, costs, expected outcomes, anticipated prognosis, possible complications, and possible contingency plans. The records must also be structured with enough detail to allow a colleague to take over therapy at any stage if needed [4].

Once the clinician is satisfied and confident that the treatment plan could meet the patient's needs and satisfy their desires, the final step is to "link the various components in a logical manner. A suggested treatment phase consists of: management of pain and emergencies and oral stabilization; prevention and disease control; followed by definitive restorative work; Review and occlusal analysis; definitive complex treatment and final maintenance and monitoring [4]. Irrespective of what gain or loss a specific treatment offers, it is important that the patient is presented with a choice and the consequences explained [5].

In this case scenario it would appear that many of these recommended steps were not followed. Nor did the clinician consider or pre-empt the possible short and long term consequences of the immediate treatment, and failed to devise a plan to prevent these, while still addressing the patient's needs. Her history of bruxing, TMJ clicking and epilepsy should have alerted the dentist to her parafunctional habits, which would almost certainly continue after the extractions. She had already developed an altered masticatory pattern since the extraction of her posterior teeth the previous year in which her mandible moved antero- superiorly in order to chew on her only remaining teeth. One could have anticipated that this habit and altered mandibular posture would continue, but now her mandibular teeth would occlude with an edentulous anterior maxillary ridge and cause the trauma seen in this report. The poor oral hygiene and plaque was a further aggravating factor that was not addressed. These teeth harboured plaque and bacteria that could have infected the opposing open sockets and should have been cleaned prior to the extractions. A more considered and pre-emptive treatment plan was needed at her initial consultation. Based on her initial panoramic radiograph (Figure 9) the two occluding posterior teeth (27 and 37) may have been retained[6]. These could have helped maintain the vertical dimension of occlusion and jaw posture, and provide retention and support for the interim partial dentures. At the same time she should have been educated on the importance of good oral hygiene and the need to maintain as many teeth as possible for bone preservation and future denture retention. Ideally she should also have had interim distal extension partial dentures fitted to prevent the posterior bite collapse, and her subsequent habit of chewing on her anterior teeth. "An interim prosthesis is designed to enhance the patient's aesthetics, stabilize the existing condition, and permit satisfactory masticatory function for a limited period of time"[2]. Such an interim appliance may also have reduced the strain on her TMJs, due to her clenching and bruxing habits. Provisional prostheses allow teeth and flanges to be added successively if and when needed, and can then be replaced with definitive dentures once the oral status has stabilised. This staggered transitional treatment approach is conservative, allows time for patient adjustment and adaptation, and permits the clinician to monitor oral hygiene and compliance. An occlusal splint on the other hand will not prevent the patient from bruxing but can help distribute masticatory forces more evenly[7].

The poor oral hygiene and plaque was a further aggravating factor that was not addressed. These teeth harboured plaque and bacteria that could have infected the opposing open sockets and should have been cleaned prior to the extractions. A more considered and pre-emptive treatment plan was needed at her initial consultation. This may have helped prevent the need for all of the extractions and adverse consequences seen in the above case scenario. Based on her initial panoramic radiograph (Figure 9) the two occluding posterior teeth

Figure 9. Original panoramic radiograph

(27 and 37) may have been retained [6]. These could have helped maintain the vertical dimension of occlusion and provide retention and support for the interim partial dentures. Oral hygiene education should have been re-inforced at each visit to ensure she remained cognisant of the need to retain as many teeth as possible for bone preservation and future denture retention. Ideally she should also have had a distal extension partial denture fitted after her posterior mandibular teeth were extracted to prevent posterior bite collapse, and her habit of chewing on her anterior teeth[7].

Alternatively, if the maxillary teeth were unsaveable, the treatment of choice should have been extraction with simultaneous provision of a complete immediate maxillary denture. These have many psychological, and functional advantages. The patient never has to be seen without teeth, the dentures restore speech, lip support and facial contour, and act as a splint / shield to protect the recent extraction sockets [6]. It is important that clinicians explore all avenues to minimise changes that accompany the loss of teeth for the sake of the patient's emotional and physical well-being[2].

CONCLUSIONS

In keeping with the principles of autonomy, beneficence, and non- maleficence,[8,9] it is imperative that before commencing any treatment the dentist spends time on the initial preparatory stages. These include conducting a thorough initial assessment, establishing an accurate diagnosis, drawing up a list of possible treatment options, and presenting these to the patient. Thereafter they should help the patient make an autonomous and educated decision as to their preferred choice. This should be followed with the formulation of a structured and carefully considered treatment plan. Adherence to these basic initial steps could help improve patient understanding, compliance and satisfaction (beneficence), and more importantly, prevent iatrogenic oral trauma (non-maleficence).

REFERENCES

1. Benjamin SD. Oral diagnosis in the general practice. Compendium of continuing education in dentistry. 2011. Vol 32(2). Accessed at: https://www.aegisdentalnetwork.com/cced/special-issues/2011/09/oral-diagnosis-in-the-general-practice. Accessed on: 02-08-2021
2. Mersel A. Immediate or transitional complete dentures: Gerodontic considerations. International dental journal. 2002. Aug; 2(4):298-303.
3. Cobb AC. Complete treatment planning: Meeting patients' needs. Inside dentistry. 2015. Vol 11. Issue 8.
4. Newsome P, Smales R., and Yip K. Oral diagnosis and treatment planning: Part 1. Introduction. Br Dent J. 2012. Vol213, No 1;15-20.
5. Ahmad I. Risk management in clinical practice. Part 5. Ethical considerations for dental enhancement procedures. Br Dent J 2010. Sep;209 (5):207-14.
6. Laney WR and Gibilisco, JA. Diagnosis and treatment planning in prosthodontics.1983. Ed Lea and Febiger; Philadelphia. Ch 9; pg208-215
7. Dalal S, Shetty O, Mistry G. Occlusal splints. International J of Dental and Medical Sciences (IOSR-JDMS). 2018.52-3.
8. Day J and Stream S. Ethics in the Dental Office: Autonomy, beneficence, non-maleficence, and justice should guide your decisions. Dental Assistant. 2018. Jul 1;87 (4):8-9.
9. Beauchamp TI and Childress, JF. 2001. Principles of biomedical ethics. New York. Oxford University Press.

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References: **1**. Mason SC. *J Clin Dent* 2009, 20(6):175-177. **2**. Layer TM. *J Clin Dent* 2009, 20(6):199-202.

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An evidence-based guide to occlusion and articulation.

Part 7: Guidelines for mechanical articulator use; conclusions and a note on complexity

SADJ August 2022, Vol. 77 No. 7 p430- p434

CP Owen[1]

SUMMARY AND PREAMBLE TO THE SERIES

Although this is essentially a review, it has not been written in the passive, third-person style normally associated with scientific writing, as it is intended to be thought-provoking and, hopefully, educational. It has therefore been written in more of a conversational style, and is aimed at students, dentists and dental technicians who are receptive to a slightly different view of occlusion and articulation, based on evidence.

Occlusion is a topic that has become a kind of archaic minefield of conflicting ideas, propositions, and above all, solutions, most of which are based on a complete lack of understanding of the evolution and development of teeth, and by extension, of clinically objective evidence.

That in itself is a statement of conflict (and perhaps even heretical), but it is by way of warning that this guide is not going to be much like anything you will find in standard text-books of dentistry or dental technology. It is, rather, an attempt to help you navigate through what you will read elsewhere, in the hope that eventually you will find an understanding that you can live with. It will appear as a sequential series in 7 Parts.

Guidelines for mechanical articulator use

First, despite all the evidence of instantaneous centres of rotation, the fact is that from a clinical point of view, we have to find a position that can be repeated, in the absence of a currently habitual intercuspal position. And even when that does exist, we have to have some means of relating the casts not only to each other but as far as is reasonably possible to at least some representation of the skull and hence to movements of the mandible in order to reduce as much as possible the final occlusal adjustments in the mouth. Hence the following suggested guidelines, based on all the evidence presented in the previous papers in this series.

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Mucosa-borne complete dentures (and removable partial dentures can be included here)

It is, perhaps, time to admit that the more complicated techniques offer no advantages, other than being impressive to the patient. Whilst the positive psychological effect of this is recognised, the same effect can – should! – be achieved by obtaining proper rapport with the patient without having to impress them with gadgets. Simplified techniques show no worse (and sometimes better) outcomes and there is ample evidence that this is the case. [1-4] In addition, there are guidelines for a minimum protocol which, although derived from expert opinion based on knowledge of the literature and experience, nevertheless condenses certain principles that are most likely to result in successful denture wearing, irrespective of the techniques used. [5] Therefore it makes sense to simplify procedures: an example is the CD4 technique.[6] In terms of articulation, there is no advantage to using anything more complicated than an average-value articulator, understanding that if changes such as vertical dimension are required, then new remounts may be required.

The occlusal goals would be bilateral centric contacts, and if possible, bilateral contacts in excursive movements as well. These are first achieved on the articulator, but then must be refined using the patient's own ability to chew, using for example, occlusal indicator wax. The evidence appears to be that it not necessary to reproduce the ideal contacts on every tooth, and so it is recommended to use an occlusal scheme such as lingualised occlusion, which makes such adjustments quick and easy to make clinically. [7] This scheme is very widely used now, and has the great advantage that it can be modified by adjustments only to mandibular teeth.

A note with respect to the elderly: whilst we can only use an observable hinge-like repeating movement of the mandible, usually guided by the clinician to a certain extent (because we need to keep hold of the mandibular denture), do not lose sight of the fact that the mandible is still held in a sling of muscles, tendons and ligaments. With age, sadly, changes occur in these structures and therefore elderly patients should be regularly recalled: those of us who have treated the elderly for conventional complete dentures know that the jaw relation you record in one year may well change when you record it, sometimes only one year later. So

Fig. 1. Examples of excessive reduction of surfaces involved in excursive movements. These have all been done in the clinics, with two having been returned to the laboratory, presumably for correction, which is unlikely to improve if the original cause – almost certainly the use of a hinge articulator – is not corrected.

a scheme like lingualised occlusion makes adjustments much easier (provided of course that you do not lose vertical dimension).

Implant- and tooth-supported overdentures

There seems no reason to change any of the principles used in mucosa-borne complete dentures except to concentrate more on achieving bilateral contacts in excursive movements. This is easier to achieve when assessing contacts in the mouth, because of the increased stability of the overdentures compared with that of mucosa-borne dentures. For example the use of occlusal indicator wax is much easier.

Fixed prosthodontics: Single restorations

I would, somewhat begrudgingly, agree that a single restoration that receives no contacts in excursive movements, may not need anything other than hand or simple hinge articulation. However, if there is any chance that there may be contacts in excursive movements, then it would make sense to use a semi-adjustable articulator, and if you can't let go of the facebow then by all means use it, but you should know that it will make no discernible difference. Adjustments will still be required in the mouth.

Fixed prosthodontics: multiple restorations, including anterior restorations

Hopefully by now this is obvious: use a semi-adjustable articulator, there is no indication for using a facebow, just mount the casts in the geometric centre of the articulator. It might be helpful to mount them with the occlusal plane at 14° to the horizontal as that is the average angle to Frankfort. The easiest way to do that is to grind the base of the model at a negative 14° to the occlusal plane. Then set the condylar guidance angles to traditionally-used average values (SCGA of 30° and MCGA to 15°).

However, it is strongly recommended to use the anterior and lateral (strictly latero-trusive) guidance as displayed by the casts, to make a custom incisal guidance table. This will make the movements of the articulator closer to those in the mouth and prevent an all too common sight such as the examples shown in Fig. 1.

These are not due to the opposing teeth producing wear through the palatal porcelain, but due to the clinician having to adjust the occlusion because the technician was not able to reproduce the anterior or lateral guidance curvatures. In all these cases, ceramo-metal crowns meant that the crowns could still remain (sort of) functional; now with the trend to all-ceramic crowns, such adjustments will most likely be fatal to the crown or the veneer or the core or both. The use of a custom-made incisal guide table will obviate or even eliminate this, and is not difficult or time-consuming to produce, as shown in Fig. 2.

Of course it is still not going to perfectly reproduce the mouth, and will require adjustments when placed. This is fine for smaller-span prostheses, but when re-organising an entire occlusion (which should be in the realm of specialists) it is necessary to make provisional restorations, and adjust those over time. These then become the templates for a new custom incisal table and for the shape and form of the definitive restorations. This makes so much sense, and is routine when carried out by specialists, but seldom seen when carried out by general dental practitioners (who shouldn't be doing this anyway!).

Although this is about articulation, do not lose sight of the evidence of cusp angles, and, within the limitations of any existing excursive contacts, try not to exceed the recommended 25° cusp angles. And remember that the changing situation mentioned above for complete dentures in the elderly also applies to fixed prostheses, another reason for keeping cusp angles shallow and providing as much freedom in centric as possible.

Implant-supported fixed prostheses

The point has been made that it is not really the implants

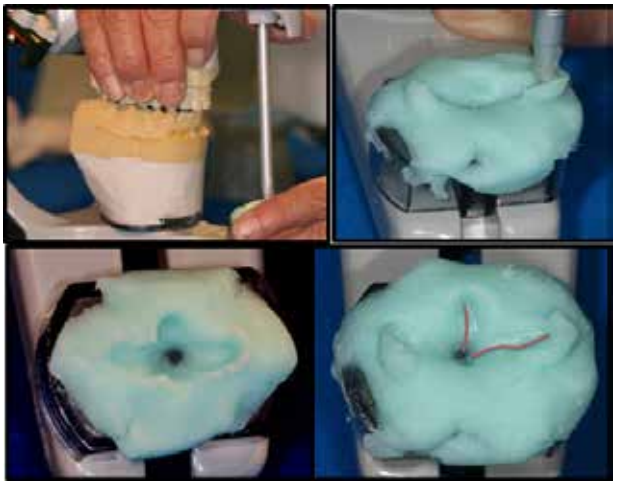

Fig. 2. The casts of the dentition before preparation are manipulated to produce a custom incisal guide from auto-polymerising resin. The red lines show the path taken in protrusive and right lateral excursive movements. Not that they are not straight because the palatal and occlusal surfaces are not straight. This will hopefully avoid the need for excessive adjustments in the mouth, as shown in Fig. 1.

that need protecting (once successfully osseointegrated of course) but the material of the superstructure, and so the concepts of distribution of forces, and freedom of movement during contact must prevail. For prostheses not involving the entire arch then ensure that the occlusal scheme is in harmony with that existing, and remember to reduce cusp angles and fissures. For full arch prostheses it makes no sense whatsoever to use a canine-guided disclusion if you approach this from a biological, functional and logical basis. It does makes sense to consider bilateral contacts in excursive movements. Therefore the logical choice of articulator is as for tooth-supported fixed prostheses, except that now you may not have the original teeth to guide the articulator by way of a custom incisal guide. In this case you must revert to the average incisal and lateral guidance angles of preferably no more than 10° and once again consider a period of provisional restorations prior to the definitive ones. Then the incisal guides can be created using casts of the (proven successful) provisionals.

CAD/CAM ceramics without any mechanical device

It has become necessary in this case to lament the lack of use of mechanical devices, contrary to all of the above. The next section will briefly deal with the virtual world of articulation, but as many specialist prosthodontists know, when patients end up in their chairs with cracked and chipped restorations, dull and lifeless looking crowns, there is far more to making a ceramic crown than just cutting a prep, taking an image, and sending it for milling. Of course, ideally, all restorations designed and created in the virtual world should be done with the use of a virtual articulator, but this may still be some way off. This is all the more reason to modify the digital library designs before milling, to reduce grooves and cusp angles. This will hopefully reduce the amount of adjustments once in the mouth, because these adjustments carry the danger of changing the height and thickness of the ceramic; this is dangerous because ceramics need to be of an even thickness, which gives them their strength. Altering the occlusal shape and form after milling is likely to create tensile forces instead of compressive ones, and it is these that initiate cracks. So only minor adjustments should be the aim, followed by polishing; and ceramics wear, whether they occlude with enamel, metal or other ceramic, so they should be polished on at least an annual basis.

But there is no doubt that the future does lie in the digital world and therefore it is necessary to use a virtual articulator, even with their current limitations (which are no worse than those of mechanical articulators), until a fully virtual patient can be created.

Virtual articulators

As I hope you will have gathered by now, there is much to learn from history, but the history of virtual articulators only goes back about 20 years, and the technological developments are so rapid that they are certainly faster than the publication of their use and efficacy. There is, though, already a fairly substantial body of work – at the time of writing, the words “virtual dental articulator” in PubMed yielded 103 useful results, dating back to the year 2000.

What is interesting, and somewhat dismaying, is that the basis for most of the current virtual articulators is the mechanical articulator, and the same reference points are still being used. So now we have virtual facebows, using either kinematic or, more commonly, arbitrary hinge axes, just as with a mechanical facebow. The idea of course, is to relate the maxillary cast to the skull, notably to Frankfort plane (although this seems to be variably defined), and then to relate the mandibular cast to the maxillary. Most current virtual articulators are mathematically derived and based on the mechanical articulator. They therefore are reproducing the same problems and false assumptions of the mechanical articulator.

But the future is brighter than that, and not far off. Already publications are reporting on success with a truly virtual patient, with a reproduction of the facial expressions, the teeth and most importantly and crucially if they are to make any sense, reproduction of the actual mandibular movements of the patient.

In summary, this is, more or less, how it all works: the first step is clearly to reproduce the teeth and this is done by scanning the entire arches. There remains, though, some controversy as to whether this can or should be done using an intra-oral scanner. A recent review felt they were not sufficiently accurate for full-arch digital implant impressions, [8] and a study purely on accuracy [9] found that precision values varied from 35 µm to 97 µm and recommended them for “single crowns, small bridges, and separate quadrant prostheses” and concluded that “Scanners based on triangulation are hardly appropriate for full-arch prostheses”. Nevertheless, many case studies have reported the successful use of full-arch scanners [10] and they are considered sufficiently accurate for removable prosthodontics. [11]

Once a digital file has been obtained, from an impression, a cast or an intra-oral scanner, then the maxillary and mandibular arches must be related to each by some means of recording the actual or desired occlusion.

Several different methods have been described recently and they won't all be described here; they range from the use of leaf gauges and anterior stops [12] to the use of interocclusal records [13] and the patient's own current habitual occlusal position using model scanners [14] or intra-oral scanners to record the buccal relationships. [8]

Then the maxillary arch must be related to the skull, and for this a virtual facebow is required when using the mathematically simulated articulator, or, preferably a CT or CBCT scan when a jaw-motion recording device is also used for a more completely adjustable virtual articulator. Once again, several techniques have been described for creating a virtual facebow, based again on the assumption that there is a hinge axis, and determining this kinematically or arbitrarily, just as with a mechanical facebow. And this can be done either completely digitally by using CT or CBCT scans to create a 3D image of the skull, [15] or using a combination of extra-oral images of the arbitrary points to locate Frankfort plane and the hinge axis [16] and even by the use of smart-phones to take a 3D scan of the face. [17] Whatever the method, the virtual articulator is then set to average values for whatever that particular software will allow: usually at least the sagittal and medial condylar guidance angles. None of which makes any sense, because of the false assumptions inherent in digitising mechanistically unsound concepts.

But far better of course would be to reproduce the patient's actual mandibular movements in all planes, and for that you need something called a jaw motion analyser. Some recent studies have described these techniques [18,19] but all of these still need to be tested using multiple clinical studies and preferably randomised clinical trials (RCTs), though these are extremely difficult and time consuming and challenging for the patients – imagine having to have different sets of full-mouth rehabilitations, using them, and then replacing them with another set made from a different articulator. No wonder RCTs are rare in Prosthodontics. However, from a functional understanding of occlusion, if the digital world can reproduce the patient's own movements then we will have a real virtual representation and this is really exciting to contemplate! I would even go so far as to say that it will have as much impact on prosthodontics as did the advent of successful titanium implants.

Conclusions to the series and a note on complexity

This series of articles has been written in the hope that some of the more arcane aspects of occlusion may be located in clinicians' and technicians' minds in a more bio-functional context. The bathwater of history is full of attempts to try to understand complex mandibular movements and is littered with wondrous mechanical devices and many misplaced 'eureka!' moments. This is not to say that mechanical devices have not played and may still play a part in treatment, but it has to be said that the purely mechanistic view of occlusion as exemplified by the gnathological schools, has ignored the fundamental purposes of what the stomatognathic system was set up for, or rather has evolved into. I hope the brief journey into the rest of the mammalian animal kingdom has helped with this understanding of why we have a hard inert substance over a soft but living substance with reparative powers ideal for a purpose that is (except under pathological conditions) now no longer required. That of course is because of the huge change to our diets, and now that we are having to deal with replacing lost anatomy, this surely has to be rooted in a functional understanding of the whole system. I hope too, that the definitions so beloved by the American Academy make a little more sense and that you can separate the nonsense from the sense. A recently published consensus review of the literature [20] is still hung up on 'centric occlusion' and 'maximum intercuspal position' and ignored the fact that there is no point. Sorry, I'll put that another way: there is no point contact but there must be freedom, so find a starting position that is repeatable and call it whatever you want, and know that the patient will function around an area, albeit a small one.

Jaw movements are amazingly complicated, and although it is necessary to simplify them, within reason, the adaptability of the system allows us to do this. I hope too, that you will now also have a different view of the joint, from it's amazing evolution during the development of the middle ear (which defines us as mammals) to its form related to the function required for the physiology of the particular animal, from joints that allow only hinge movements to joints that allow wide circular movements, to joints that can combine all necessary movements.

It is, though, the digital world that is most likely to give us the most help, but I fear that many of the pioneers in this world may have been too rooted in their mechanistic past. Virtual articulators of the mathematically derived type are merely the equivalent of a semi-adjustable articulator set to average values. What is most exciting is that we are close to having a virtual articulator that simulates the patient's own jaw movements, because after all, that's what we use when we finally adjust our restorations in the patient's mouth. If we can get as close to that as possible in the virtual world, using the modern ceramics (and preferably, in my opinion, the IPN ceramics), then the likelihood of having to do adjustments that will weaken the integrity and therefore the strength of those restorations is much diminished. That's an exciting future!

Finally, a word about complexity and a caveat. The digital world and the newer restorative materials have the potential to fool us into thinking we can do almost anything now. But it has taken some of us many decades to work out just what we should be doing when placing restorations into real, not virtual, mouths. In the UK, the National Health Service has developed levels of difficulty mainly in response to a billing system, but it has been suggested that this could also provide guidance as to who should be doing what. For example, in South Africa it takes four years of very intensive education and training to become a prosthodontist and a few more years to become an expert prosthodontist. Yet we are increasingly seeing general practitioners without such education and training carrying out full mouth rehabilitations, often at the chairside, and often 'instantly'. This has prompted the litigation insurers to express some considerable concern (McKelvie A, personal communication) as they are increasingly being

advised by expert witnesses to settle claims when general dental practitioners have exceeded their level of expertise. I mention this just as a caveat (and it is the topic of a future paper) to those practitioners embarking on complex treatment to understand the fullest extent of the knowledge they ought to have. That has been one of the reasons for writing this series of papers.

REFERENCES

1. Ellinger CW, Wesley RC, Abadi BJ, Armentrout TM. Patient response to variations in denture technique. Part VII: Twenty-year patient status. J Prosthet Dent. 1989;62(1):45-8. doi: 10.1016/0022-3913(89)90045-0
2. Regis RR, Cunha TR, Della Vecchia MP, Ribeiro AB, Silva-Lovato CH, de Souza RF. A randomised trial of a simplified method for complete denture fabrication: patient perception and quality. J Oral Rehabil. 2013;40(7):535-45. doi: 10.1111/joor.12063.
3. Mengatto CM, Gameiro GH, Brondani M, Owen CP, MacEntee MI. A Randomized Controlled Trial of Mastication with Complete Dentures Made by a Conventional or an Abbreviated Technique. Int J Prosthodont. 2017;30(5):439–444. doi: 10.11607/ijp.4741.
4. Kawai Y, Muarakami H, Feine JS. Do traditional techniques produce better conventional complete dentures than simplified techniques? A 10-year follow-up of a randomized clinical trial. J Dent. 2018;74:30-36. doi: 10.1016/j.jdent.2018.04.027
5. Owen CP. Guidelines for a minimum acceptable protocol for the construction of complete dentures. Int J Prosthodont. 2006 Sep-Oct;19(5):467-74.
6. Owen CP, MacEntee M. The CD4 Denture Technique – Complete dentures delivered in three visits. Available at www.appropriatech.com
7. Owen CP. Lingualised Occlusion. An eBook module. Available at www.appropriatech.com
8. Zhang YJ, Shi JY, Qian SJ, Qiao SC, Lai HC. Accuracy of full-arch digital implant impressions taken using intraoral scanners and related variables: A systematic review. Int J Oral Implantol. 2021;14(2):157-179
9. Sacher M, Schulz G, Deyhle H, Jäger K, Müller B. Accuracy of commercial intraoral scanners. J Med Imaging. 2021;8(3):035501. doi: 10.1117/1.JMI.8.3.035501
10. Lepidi L, Galli M, Mastrangelo F, Venezia P, Joda T, Wang HL, Li J. Virtual Articulators and Virtual Mounting Procedures: Where Do We Stand? J Prosthodont. 2021;30(1):24-35. doi: 10.1111/jopr.13240.
11. Lo Russo L, Caradonna G, Troiano G, Salamini A, Guida L, Ciavarella D. Three-dimensional differences between intraoral scans and conventional impressions of edentulous jaws: A clinical study. J Prosthet Dent. 2020;123(2):264-268. doi: 10.1016/j.prosdent.2019.04.004.
12. Radu M, Radu D, Abboud M. Digital recording of a conventionally determined centric relation: A technique using an intraoral scanner. J Prosthet Dent. 2020;123(2):228-231. doi: 10.1016/j.prosdent.2018.12.004.
13. Seo JM, Oh WS, Lee JJ. A technique for verifying the accuracy of the virtual mounting of digital scans against the actual occlusal contacts. J Prosthet Dent. 2019;121(5):729-732. doi: 10.1016/j.prosdent.2018.08.003.
14. Yee SHX, Esguerra RJ, Chew AAQ, Wong KM, Tan KBC. Three-Dimensional Static Articulation Accuracy of Virtual Models - Part I: System Trueness and Precision. J Prosthodont. 2018;27(2):129-136. doi: 10.1111/jopr.12723.
15. Lepidi L, Chen Z, Ravida A, Lan T, Wang HL, Li J. A Full-Digital Technique to Mount a Maxillary Arch Scan on a Virtual Articulator. J Prosthodont. 2019;28(3):335-338. doi: 10.1111/jopr.13023
16. Solaberrieta E, Garmendia A, Minguez R, Brizuela A, Pradies G. Virtual facebow technique. J Prosthet Dent. 2015;114(6):751-5. doi: 10.1016/j.prosdent.2015.06.012.
17. Li J, Chen Z, Decker AM, Wang HL, Joda T, Mendonca G, Lepidi L. Trueness and Precision of Economical Smartphone-Based Virtual Facebow Records. J Prosthodont. 2021 Apr 20. doi: 10.1111/jopr.13366. Epub ahead of print.
18. Li Q, Bi M, Yang K, Liu W. The creation of a virtual dental patient with dynamic occlusion and its application in esthetic dentistry. J Prosthet Dent. 2020 Dec 12:S0022-3913(20)30593-X. doi: 10.1016/j.prosdent.2020.08.026. Epub ahead of print.
19. Li L, Chen H, Zhao Y, Wang Y, Sun Y. Design of occlusal wear facets of fixed dental prostheses driven by personalized mandibular movement. J Prosthet Dent. 2021 Feb 3:S0022-3913(20)30723-X. doi: 10.1016/j.prosdent.2020.09.055. Epub ahead of print.
20. Kattadiyil MT, Alzaid AA, Campbell SD. The Relationship Between Centric Occlusion and The Maximal Intercuspal Position and Their Use as Treatment Positions for Complete Mouth Rehabilitation: Best Evidence Consensus Statement. J Prosthodont. 2021;30(S1):26-33. doi: 10.1111/jopr.13316

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What's new for the clinician– summaries of recently published papers

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1.The relationship between general health and lifestyle factors and oral health outcomes

There is substantial published literature describing the relationship between systemic health and oral, particularly periodontal health[1]. To list a few, periodontal diseases have been linked to cardiovascular diseases, high blood pressure, stroke, diabetes, dementia, respiratory diseases, and mortality, where an inflammatory pathway was depicted.[1] Another line of research has examined the association between the number of teeth, severe dental caries, and general health among older adults and children, suggesting a nutritional pathway.[1]

In the United Kingdom (UK), DEPPA, the Denplan PreViser Patient Assessment, is used an online tool that assesses patients' risk of developing future oral disease and their current oral health status is recorded using the composite 'Oral Health Score' (OHS) . Online questionnaires are completed by patient and practitioner using data collected in a routine examination.

Traffic light coloured, personalised reports are instantly generated using PreViser's evidence-based algorithm. Such measures offer potentially valuable signposts for patient engagement, education and motivation towards behaviour change. Standard clinical practice commonly employs separate measurements for each aspect of oral health, however, validated composite measurements are valuable in providing patients with a holistic summary of their oral health outcomes and facilitate oral health improvement targets.

Sharma and colleagues (2016) [1] reported on a study that sought to report on the association between current oral health status of patients, as measured using the OHS, and patient-reported risk factors and general health in the preceding year. The primary research question addressed in this paper was 'are lower than average oral health scores observed for those patients who report problems with general health and high-risk lifestyle factors?'

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METHODS AND MATERIALS:

Data from the first 37,330 patients to receive a DEPPA at their dental practice was analysed. A total of 493 different dentists contributed patient assessments to this population.

The oral health score (OHS) is generated based upon patient-reported domains such as oral pain, function (eating), appearance, fluoride exposure, etc and a clinical dental examination. These scores are recorded online in DEPPA and are then used by the embedded algorithms to produce the composite OHS for each patient based upon their current oral health status. These scores are out of a maximum of 100 which equates to perfect oral health and lower scores indicate worse oral health status.

The remaining general health and lifestyle questions relate to questions on smoking and alcohol consumption, presence of diabetes, oral cancer, etc.

The data submitted by practices during a DEPPA are held centrally in an encrypted and de-personalised form so that only the submitting practice can identify individual patients. The DEPPA database was interrogated to report the OHS for each patient as well as lifestyle factors including diabetes, tobacco use, alcohol consumption and any major health problems in the preceding year as a surrogate for the overall general health of patients.

The association between the self-reported general health and OHS of patients within the DEPPA database was reported unadjusted and adjusted for the following covariates: age; self-reported diabetes status (yes or no); tobacco use (ever smoked cigarettes, cigars or pipe or used smokeless tobacco); alcohol status (none, <1 drink/day, 1 drink/day, 2 drinks/day, 3 or more drinks/day); presence of acid reflux (yes or no); and conditions causing vomiting at least once a week (yes or no). Also included as covariates were dental assessments of inadequate saliva flow (yes or no) and dental attendance (less than recommended or as recommended). These covariates were included as they could possibly confound the association between general health and OHS by influencing both.

RESULTS

All 37,330 patients in the DEPPA database at the census point for data extraction were included in the analysis. The mean age of participants was 54 years (range 17–101; S.D. 16 years) and the mean OHS for the group was 78.4 (range 0–100; S.D. 10). A total of 1,255 (3%) of patients reported experiencing a major health problem in the last year, 1,875 (5%) reported having diabetes, 22,925 (61%) reported no tobacco use ever, 7,723 (21%) reported no alcohol intake, 345 (1%) reported a health condition that predisposes to vomiting at least once a week and 4,463 (12%) reported acid reflux into the mouth. The dentists assessed inadequate saliva flow in 608 (2%) patients and less than recommended dental attendance in 2,213 (6%) of patients.

Patients who self-reported to have experienced a major health problem within the previous year (N = 1,255) were significantly older and had a lower OHS than patients who did not report experiencing a major health problem in the last year. Such patients were also more likely to have diabetes, use tobacco, be teetotal, experience reflux or vomiting, have inadequate saliva flow and be infrequent attenders to their dentist.

A multivariable analysis undertaken demonstrated that, accounting for all other covariates mentioned, having diabetes was associated with a 1.7 point drop in OHS compared to no diabetes, tobacco use was associated with a 2.7 point drop in OHS compared with no tobacco use, excessive alcohol consumption (three or more glasses) was associated with a 1.8 point drop in OHS compared with no alcohol consumption and less than recommended dental attendance was associated with a 7.3 point drop in OHS compared with recommended dental attendance. The OHS also decreased in a dose-dependent manner with age with each increase in decade being associated with a 2-point drop in OHS.

In the fully adjusted model, patients who reported major health problems in the last year had a mean OHS that was 3.5 points, 0.7 points (95% CI 0.2-1.2, P = 0.006) lower than those that did not report such problems.

CONCLUSIONS

The current study has demonstrated that patient reported general health and risk factors were negatively associated with an overall composite oral health score outcomes.
Implications for practice: While the clinical significance of some of the reported associations was unknown, the data lends support to the growing body of evidence linking the oral and systemic health of individuals. Therefore, oral health professionals may be in a unique position to influence the lifestyle and general health of patients as part of their specific remit to attain and maintain optimal oral health.

REFERENCE

1. Sharma P, Busby M, Chapple L, Matthews R, Chapple I. The relationship between general health and lifestyle factors and oral health outcomes. British dental journal. 2016; 221: :65-9.

2. Gluten-free foods: a 'health halo' too far for oral health?

Gluten is a family of proteins found in wheat, barley, rye and spelt. Its name comes from the Latin word for “glue,” as it gives flour a sticky consistency when mixed with water. This glue-like property helps gluten create a sticky network that gives bread the ability to rise when baked. It also gives bread a chewy and satisfying texture. Unfortunately, many people feel uncomfortable after eating foods that contain gluten. The most severe reaction is called celiac disease.

The modern trend for a healthier lifestyle, the desire to lose weight and eating healthier foods has resulted in a number of lifestyle trends, one of which is the adoption of a “gluten-free” diet. Supermarkets, and many food outlets have pandered to this trend and many of them have Gluten-free isles where a variety of gluten-free foods are available.

Some researchers have described a 'health halo' effect related to health foods. They defined the term as the presence of a health claim which induces the consumer to rate the product higher on other attributes not mentioned in the claim. For example, 'low fat' being regarded as healthy even if the product is low in fibre and high in sugar. The sugar content in these foods is of major interest to oral health professionals as sugar consumption is a well-known risk factor for dental caries. Also, an increase in sugar consumption can have a detrimental effect on general health, leading to weight gain and consequently, an increased risk of heart disease, type II diabetes mellitus, obesity and stroke.

Rothburn and colleagues (2022) [1] reported on a study that sought to assess the sugar and energy content of Gluten-free (GF) food from the perspective of those consumers who are not suffering from clinical gluten sensitivity (for example, coeliac disease) or non-coeliac gluten sensitivity on oral and general health.

MATERIALS AND METHODS

This was a UK based study. The methodology comprised a content analysis of food packaging for a purposively selected range of gluten-free products and their gluten-containing versions. Food products were sourced from all the major UK supermarkets with an online presence, that is, Tesco, Asda, Lidl, Sainsbury's, Morrisons and Waitrose.. Where possible, pairings or comparisons were made from the same own brand or branded product, for example, Warburton's GF and gluten-containing white bread. All of the selected foods were either cereal or cereal products, which corresponded with the NHS 'foods containing gluten unsafe to eat for coeliac disease sufferers' list. The National Diet and Nutrition Survey (NDNS) cereal and cereal products food group sub-categories were used to classify the selected food items for data collation and analysis. Further classification was by product description, for example: Category 1: 'ready meal'; Category 2: pasta, rice, pizza and other miscellaneous cereals and Category 3: 'korma and rice'.

The nutritional information on the front and back of package labels was collated using Microsoft Excel. This culminated in the data variables in terms of product and nutritional attributes reviewed.

The use of emotive marketing language in the product packaging was also assessed. Also, front of pack (FOP) labelling indicating which products were green (low), amber (medium) or red (high) with regard to total sugars (including, for example, sucrose, fructose, glucose, maltose, lactose) was recorded.

RESULTS

In total, 15 Gluten-free (GF) products and their gluten-containing versions, available to UK consumers, were purposively selected for this study.

The main GF food products surveyed were 'baked goods', accounting for 76% (19/25), with 'buns, cakes and pastries' predominating this National Diet and Nutrition Survey (NDNS) food category (7 out of 19, 36.8%), followed by 'biscuits' (5 out of 19, 26.3%). Four ready meals and two breakfast cereal pairings were also studied.

Gluten-containing product pack sizes ranged from 96 g (shortbread fingers) to 1,000 g (vanilla cheesecake, ten portions). For GF products, sizes ranged from 90 g (two cupcakes) to 570 g (vanilla cheesecake, six portions). This indicated a need to compare products per 100 g for a direct nutritional comparison.

The largest size differences in portion sizes were for the ready-to-eat meals. The three GF ready meals (lasagne, macaroni cheese and korma) were 120-181 g smaller than the gluten-containing pairing. Portion sizes for bread were also consistently smaller for the GF products, ranging from 10-26 g smaller per pairing.

A consumer purchasing all 25 items containing gluten would have spent £52.28 at the time of the research, while those purchasing the GF alternatives would have spent £7.19 more, that is, £59.47. For high-sugar products, such as buns, cakes, pastries and puddings, the GF alternatives were cheaper, whereas GF staple items, like bread and pasta, were more expensive when compared with the gluten-containing pairings. A comparison of cost (in £ sterling) per 100 g highlighted that all GF product categories were considerably higher.

On average, the GF products contained more calories, carbohydrates and sugar than the gluten-containing products. GF foods contained 7% more sugar on average than gluten-containing foods. For GF products, the sugar content ranged from 2.4 g/100 g for Amy's Kitchen macaroni and cheese to 49.0 g/100 g for Tesco's chocolate wafers. Whereas the range for gluten-containing products was from 1.2 g/100 g for the Sainsbury's macaroni and cheese to 46.2 g/100 g for Tesco's chocolate wafers.

The total energy content for gluten-containing products was 310 kcal versus 321 kcal for GF products. The largest difference in energy kcal per 100 g was for wholemeal

bread 221 kcal/100 g in gluten-containing versus 256 kcal/100 g in GF wholemeal bread.

Overall, the GF products contained 1.3 times more sugar than their gluten-containing counterparts (18 g:14 g). Only two gluten-containing products (white bread and pizza) contained more sugar out of the 50 products analysed. The greatest difference in sugar content per 100 g was the puddings category (23 g in the gluten containing versus 32 g in the GF versions)

The average portion size was determined by the manufacturer's information clearly stated on the packaging of the products. GF products contained more sugar in baked items, such as biscuits, buns, cakes, pastries and puddings, as well as breakfast cereals, when compared with their gluten-containing counterpart.

Out of the 50 items analysed, 25 (14 GF, 11 gluten-containing) products were classified as high in sugar (over 22.5 g/100 g) according to the Department of Health, highlighted as 'red' following the front of pack traffic light system.

The analysis of the product packaging highlighted that the majority of the GF products used emotive language in order to persuade the consumer to buy the product. Phrases like 'food for health conscious people too busy to cook'; 'just because its gluten-free, it doesn't need to be fun free'; 'all natural ingredients'; 'this is genius'; 'freedom to enjoy the food you love'; and 'deliciously gluten-free' highlight that GF brands are targeting consumers both with medical and non-medical conditions, encouraging them to purchase GF products as they appear to be hiding beneath a 'health halo'.

Conclusions: This study highlights that a Gluten-free diet does not necessarily provide an improved healthier lifestyle, unless medically necessary.

Implications for practice:

This study emphasises the 'health halo' phenomena, where foods for special diets are regarded by consumers as healthy when in fact they are not. It is important that members of the dental team are aware of the possible implications of a gluten-free diet where it is not medically indicated, coupled with reliance on convenience foods.

REFERENCE

1. Rothburn N, Fairchild R, Morgan M. Gluten-free foods: a 'health halo' too far for oral health? British Dental Journal (2022). https://0-doi-org.innopac.wits.ac.za/10.1038/s41415-022-4424-2

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CPD questionnaire on page 444

The Continuous Professional Development (CPD) section provides for twenty general questions and five ethics questions. The section provides members with a valuable source of CPD points whilst also achieving the objective of CPD, to assure continuing education. The importance of continuing professional development should not be underestimated, it is a career-long obligation for practicing professionals.

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Misleading advertising – What is our duty as dental professionals towards our patients and the public?

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ABSTRACT

There are currently several media adverts on radio and television in which "experts" confidently inform the public of their unique kinds of toothpaste which not only strengthen but can rebuild enamel and lost tooth substance.The concerns raised in this paper relate to pharmaceutical companies preying on uninformed, concerned, and often-compromised consumers to promote their products. To this end, some make fallacious claims, misrepresent or overinflate their products' therapeutic potential, which all overtly or covertly create false hopes and unrealistic expectations. The profession needs to collectively identify a body that will monitor the information presented to the public by dental manufacturers, advertising bodies, and social media websites. If we stand by and say nothing, we agree with the data and legitimize the product. Dental clinicians need to be more accountable, active, and visible on television, social media sites and in popular publications providing educational information and, if necessary, dispelling false perceptions. We have a duty to the public

Introduction

A 10-year-old patient presented to our clinic complaining of severe tooth sensitivity, poor aesthetics, and badly broken-down teeth. Her father reported that his daughter was becoming increasingly self-conscious about her smile and had been constantly teased at school. He added that she always had "weak" teeth that were treated with extraction. Without a clinical examination, this would suggest that the child had suffered from poor oral hygiene and dental decay. Intraoral examination revealed severely broken down teeth, missing teeth, and teeth that were stained yellow, but the patient's oral hygiene was excellent. The father confirmed that his daughter was meticulous about brushing her teeth at least three times a day and that they had purchased "special toothpaste" purported to "rebuild lost enamel." To his surprise, he confessed that the toothpaste had not rebuilt the enamel no matter how often it was used. Further clinical assessment, history taking, and radiographic investigations led to a diagnosis of Amelogenesis Imperfecta type III according to the Witkop and Rao (1971) classification[1]. The parents were visibly upset when the condition was explained to them, especially when they were told that no amount of brushing or toothpaste could restore lost tooth structure; it had done quite the opposite and accelerated the loss of enamel from her already compromised teeth.

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2. George P Babiolakis 40%;

The issues of concern

The above case scenario was a stark reminder of how we as a profession have been failing our patients by our inactivity. At the time of writing this paper, there are currently several media adverts on radio and television in which "experts" confidently inform the public of their unique kinds of toothpaste which not only strengthen but can rebuild enamel and lost tooth substance. They substantiate their claims by adding that 9 out of 10 dentists recommend their product. A Google search for remineralizing toothpaste revealed countless dental toothpaste products, all loaded with advertorial hype, written using emotive language and promising to deliver life-changing benefits. Most sites have a leading (Misleading?) heading in bold print, which is all consumers generally read and remember. The more carefully constructed text follows this heading in small print. The latter is often cleverly worded to suggest many benefits but uses terms that still leave room for plausible deniability if challenged. The following examples were taken directly taken from various websites:

"Don't Let Sensitive Teeth Affect Your Everyday Life. Make a Change Today! Specialist Whitening. Proven sensitivity relief. Complete Protection. Enamel Protection. Long Lasting Protection. Repair & Protect. Relief In 60 Seconds. Removes Stains. Rapid Relief" [2].

" Pro Duct X is clinically proven to rebuild enamel strength, protecting against the effects of everyday acids". Acid erosion can threaten the long-term health of your teeth, so it's important to know how to protect your teeth from its irreversible effects. Pro Duct X toothpaste is a key ingredient in that line of defence and preservation—it helps protect your tooth enamel from further damage. It is specially designed to help re-harden precious, acid-

softened tooth enamel. With a low-abrasive, pH neutral formulation. Pro Duct X toothpaste helps protect your enamel while you brush your teeth. Are You Protecting Your Enamel?" [3].

Notice how the title states that it is proven to rebuild enamel. The unsuspecting consumer will interpret this to mean that it can restore lost enamel. If they read further, they may be forgiven for believing that the "*healing*" will be even better and faster the more they use it, as it states, "*helps protect your enamel while you brush your teeth.*" The clever addition of the word "*strength*" to the title covers the manufacturer against the erroneous assumption that it can rebuild actual tooth enamel.

Some sites are more cautious in their adverts but still suggest that more frequent brushing will lead to better results. They often also add the promise of tooth whitening, which they know will appeal to the aesthetically conscious public. "*Brushing regularly with a remineralizing toothpaste such as Pro Duct X is one of the best methods of strengthening tooth enamel. Every time you brush your teeth with fluoride toothpaste, your tooth enamel absorbs a small amount of fluoride, which replaces the minerals that have been lost. Over time, the existing enamel becomes stronger and more resistant to decay*" [4].

Suppose one does read until the very end of the long small print section. In that case, you will find a line that the advertisers can use in their defence as they mention, "And remember, remineralizing toothpaste doesn't treat cavities. But it sure does help prevent them!".

What about those companies who "use" us professionals without our consent? A famous television advert states, "*Nine out of ten dentists recommend……*". We all know hundreds of dentists; how many of you or your colleagues have ever been interviewed? Furthermore, who were the dentists, they asked? How many did they include in their sample? Who conducted the survey? How many of them had access to the laboratory or clinical evidence to enable them to recommend the product? On what grounds did the dentists base their recommendations?[5]. Perhaps the advert would be more accurate if it stated, "*None out of ten dentists preferentially recommend……*" and also elaborate why the ONE did not.

There can be no doubt that adverts work in both promoting and creating a public demand for specific products. A few more minutes of web scrolling for toothpaste revealed 28 products on just one site. It is interesting to note, the wording used to describe each of the listed ingredients and the vastly differing prices (these ranged from R56.99 to R549.00 per tube - the current rate for a regular toothpaste is R22.99 and for the Big Mac index is R 54.99). They all have similar descriptors, but each adds its unique ingredient or engaging name, such as:

- Doctor Zed's toothpaste
- Hydroxyapatite containing, Non-foam toothpaste
- Remineralizing paste with crystal toothbrush
- Remineralizing toothpaste with whitening charcoal
- Superwhite toothpaste
- Charcoal toothpaste with hydroxyapatite
- Protective repair toothpaste
- Decay protect toothpaste
- Daily protection toothpaste
- Intensive enamel repair toothpaste
- Stop sensitivity gel
- Mineral rich evening toothpaste
- Professional original toothpaste
- Perioplus toothpaste
- Daily gum health toothpaste
- Fast sensitive repair toothpaste
- Dental cream repair tube
- Gum and enamel repair toothpaste
- Repair and protect paste
- Mint tooth mousse

This extensive list even includes remineralizing and tooth whitening tablets, which are advertised as "*Remineralizing toothpaste tablets with high gloss teeth, whitening.*" These cost an exorbitant R658.00 for 62 tablets [6]. A different search for children's toothpaste showed an equally high number of products marketed with labels such as "*homeopathic,*" *"fizzy bubble gum flavored," "designed by dental experts,"* and *"fun, fresh, and healthy."* It is concerning that there are also *"tooth whitening"* pastes for children, as well as a number that are *"specially formulated and fluoride free for children."* Once again, the costs vary widely, with some *"exclusive"* brands having highly inflated price tags.

Ethical concerns and considerations

The concerns raised in this paper relate to pharmaceutical companies preying on uninformed, concerned, and often-compromised consumers to promote their products. To this end, some make fallacious claims, misrepresent or overinflate their products' therapeutic potential, which all overtly or covertly create false hopes and unrealistic expectations. This may result in patients wasting time and money on products or treatment regimes that do not fulfill all promises or provide the desired benefits. Worse still is that some may even cause harm to unwitting patients if incorrectly used.
How do manufacturers get away with this? They rely on the fact that most consumers accept and believe what they see, hear, and read without question. In addition, Multipharma companies are often huge, well-established, recognized, trusted, rich, and influential. They can afford widespread and flamboyant adverts and lawyers to defend them against anyone who may challenge their claims. However, we cannot blame the unsuspecting public or the competitive commercial industry for the current situation.

The fundamental ethical concern lies with the dental profession. For too long, clinicians have sat back and watched the market explosion yet have never individually or collectively voiced any concerns. Many even condone the process by preferentially promoting specific products in the form of free samples that they display in their waiting rooms and hand out to patients. What a clever and cheap advertising strategy for the representatives who supply these! These samples may also be accompanied by *"kickbacks"* in exchange for a guarantee that the clinician will encourage their use amongst patients and/or purchase other materials and

equipment from that same company. Some more sinister perks are disguised as gifts, free lunches, entries into *"lucky draws,"* free registration at CPD events, and even luxurious holidays. Once a person has been *"bought,"* it becomes tough for them to challenge the purse-holder. It is easier to turn a blind eye to misleading adverts or unproven claims, but in doing so, their inactivity equates to acceptance and consent. Are we, as educated professionals, easily bribed and bought? One would like to believe that the current silence amongst dentists reflects an attitude of apathy rather than moral dearth/decline. In either case, do we need to seek and implement measures to rectify the problem?

Dentists' moral and ethical duties and obligations

The profession needs to collectively identify a body that will monitor the information presented to the public by dental manufacturers, advertising bodies, and social media websites. If we stand by and say nothing, we agree with the data and legitimize the product. But who amongst the fraternity is questioning the validity of research that accompanies promotional campaigns? Company-sponsored research needs to be even more vigilantly monitored as it has a much higher potential for conflict of interest on the part of the researchers. Why are dental academics who publish research on new materials not taking legal action against false advertising and defective products if they encounter these in their studies? Ethical conduct obligates those who embark on research to publish positive and negative findings and proactively intervene to safeguard the community in identifying potential harms.

It reminds one of the stories titled *"Whose job is it anyway?"* (Reproduced verbatim from the writing of Lolly Daskal)[7].

"This story is about four people named Everybody, Somebody, Anybody, and Nobody. There was an important job to be completed. Everybody was sure that Somebody would do it. Anybody could have done it, but Nobody did it. Somebody was angry because it was Everybody's job. Everybody thought that Somebody would do it, but Nobody realized that Everybody would not do it. In the end, Everybody blamed Somebody when Nobody did what Anybody could have done" [7].

So which Body are dentists now relying on to monitor the media and to protect and educate the public? It seems that Everybody thinks it will be done by Any of the associated Bodies or Academic institutions such as SADA, HPCSA, BHF, ASA, CMSA, UP, UWC, SMU, or Wits? As such, Everybody is sitting back complacently, and Nobody is addressing the problem or need.

CONCLUSION

It is now time that individual dental clinicians become more accountable, active, and visible on television, social media sites and in popular publications providing educational information and, if necessary, dispelling false perceptions. We have a duty to the public – whether our patients or not – to help promote their oral health and general well-being and to protect them from potential harm. Is this not what we pledged to do when we took the Hippocratic Oath?

REFERENCES

1. Witkop CJ Jr, Rao S. Inherited defects in tooth structure. Birth defects: Original Article Series 1971; 7:153-84
2. SensodyneAbout Sensitivity | You and Your Dentist. Accessed at:https://www.sensodyne.co.za/; Accessed on 19-08-2022
3. Why Pronamel? – Sensodyne South Africa. Accessed at: https://www.sensodyne.co.za/pronamel.html; Accessed on 19-08-2022
4. Best remineralizingtoothpase for enamel / Colgate. Accessed at:https://www.google.com/search?q=remineralizing+toothpaste&rlz. Last Updated: March 8, 2022 Accessed on 19-08-2022
5. Sensodyne ordered to stop misleading advertising. Accessed at: https://www.hindustantimes.com/business/sensodyne-ordered-to-stop-misleading-ads-consumer-body-ccpa-slaps-rs-10-lakh-fine-101647970763319.html; Accessed on 24-08-2022
6. Hydroxyapatite toothpaste: What it is, and Best brands. Accessed at: askthedentist.com>hydroxyapatite-toothpaste. Accessed on 20-08-2022
7. Lolly Daskal. The Leadership Gap. Quotes by Lolly Daskal. Accessed at: www.goodreads.com>work>quotes. Accessed on: 21-08-2022-08-21

http://dx.doi.org/10.17159/2519-0105/2022/v77no7a10

Maxillofacial Radiology 202

SADJ August 2022, Vol. 77 No.7, p442 - p443

C Smit[1], L Robinson[2]

CASE

A 30-year-old male patient, RVD-reactive on treatment, presented with a fast-growing, painful swelling involving the mandible of unknown duration. A panoramic radiograph (PR) and cone-beam computed tomography (CBCT) imaging were performed. What are the pertinent radiological features and your diagnostic hypothesis?

Fig. 1: Panoramic radiograph

INTERPRETATION

The panoramic radiograph showed a poorly-defined, hazy and sclerotic appearance of the anterior mandibular bone. CBCT imaging showed a poorly-defined, hyperdense lesion resulting in a so-called "sunburst" periosteal reaction of the anterior mandible. This periosteal reaction extended to involve the mandible bilaterally. These features supported the histopathological diagnosis of osteosarcoma.

Osteosarcomas are a group of malignant bone neoplasms that constitute approximately 50% of all skeletal malignancies, with 10% of cases occurring within the jawbones.[1] Osteosarcomas may arise de novo or following radiotherapy to the head and neck region.[2] They present with a near equal gender distribution and at a median age of 38 years, with males often presenting at an earlier age.[3] The mandible (56%), maxilla (32%), paranasal sinuses (10%), and the rest of the skull including the skull base (2%) are affected in decreasing frequencies.[1]

The most common presentation is that of a painful or painless swelling present for a short period.[1] Radiologically, they present as poorly-defined osteolytic, mixed or osteogenic lesions.[2] Periosteal reactions are common (65%) and may be laminated or spiculated.[2] Soft tissue invasion is seen in 48% of cases.[1] Treatment consists of primary surgical resection and neoadjunct chemo- or radiotherapy in many cases.[1] The 5-year disease-free

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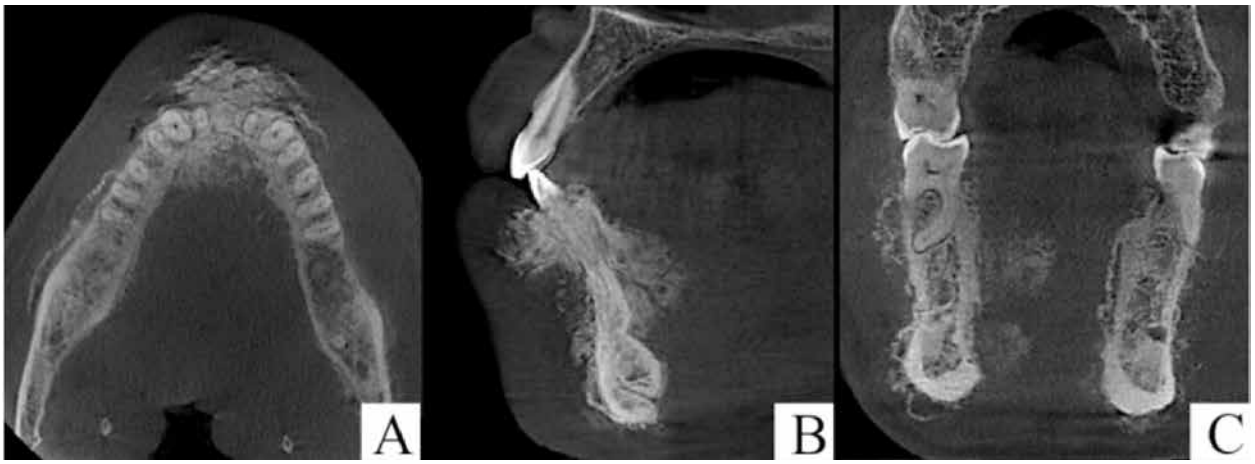

Fig. 2: (A) Axial, (B) sagittal and (C) coronal CBCT images

survival rate has been estimated at 60%[3], with a median overall survival of 46 months.[1] Factors associated with a worse prognosis include patients over the age of 60 years, location other than the mandible, tumours larger than 6cm, histologic subtype, initial non-surgical therapy, and positive resection margins.[3]

It is the dentist's responsibility to recognise the early radiological signs, particularly mobile teeth with symmetrical widening of the periodontal ligament space in the absence of periodontal disease. This will ensure early patient referral and diagnosis, and improve overall survival rates.

Authors declaration
Funding
This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflict of Interest
The authors declare that they have no conflict of interest.

Ethics approval
This study was approved by the University of Pretoria, Faculty of Health Sciences Research Ethics Committee (Reference no.: 411/2022). All procedures followed the ethical standards of the Helsinki Declaration of 1975, as revised in 2008.

REFERENCES

1. Laskar S, Basu A, Muckaden MA, D'Cruz A, Pai S, Jambhekar N, Tike P, Shrivastava SK. Osteosarcoma of the head and neck region: lessons learned from a single-institution experience of 50 patients. Head & Neck: Journal for the Sciences and Specialties of the Head and Neck. 2008 Aug;30(8):1020-6.
2. Luo Z, Chen W, Shen X, Qin G, Yuan J, Hu B, Lyu J, Wen C, Xu W. Head and neck osteosarcoma: CT and MR imaging features. Dentomaxillofacial Radiology. 2020 Feb;49(2):20190202.
3. Smith RB, Apostolakis LW, Karnell LH, Koch BB, Robinson RA, Zhen W, Menck HR, Hoffman HT. National Cancer Data Base report on osteosarcoma of the head and neck. Cancer: Interdisciplinary International Journal of the American Cancer Society. 2003 Oct 15;98(8):1670-80.

CPD questionnaire on page 444

The Continuous Professional Development (CPD) section provides for twenty general questions and five ethics questions. The section provides members with a valuable source of CPD points whilst also achieving the objective of CPD, to assure continuing education. The importance of continuing professional development should not be underestimated, it is a career-long obligation for practicing professionals.

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CPD questionnaire

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

GENERAL

Stressors in Dental Students During the Transition from Theory to Practice: A Qualitative Research

1. Choose the CORRECT answer. What is the primary factor affecting mental health?
   A. Anxiety
   B. Stress
   C. Insomnia
   D. Systemic diseases

2. Which of the following answers is CORRECT. The most harmful effect of stress is
   A. Disruption
   B. Impairment of effective performance
   C. Thinking power
   D. All of the above

3. Which of the following options is CORRECT. There was a lack of time according to student feedback citing which department
   A. Endodontics
   B. Periodontics
   C. Oral medicine
   D. Pediatric dentistry

4. Select the CORRECT answer. A study on dental students in Babol (Ref.26) showed that dental students experienced
   A. High stress
   B. Low stress
   C. Moderate stress
   D. Very high stress

5. Select the CORRECT answer. What is the cause of stress in students in Malaysia?
   A. Fear of failure
   B. Heavy workload
   C. Problems dealing with patients
   D. Lack of cooperation between professors and patients

Knowledge, Attitudes and Practices of Emergency Care Practitioners in the Management of Common Dental Emergencies in the eThekwini District, KwaZulu-Natal.

6. Choose the CORRECT answer. The management of dental emergencies is often
   A. included in medical courses and first aid trainings
   B. included minimally in medical courses and first aid trainings
   C. given priority in medical courses and first aid trainings
   D. not included in medical courses and first aid trainings

7. Which one of the following is CORRECT. How many years of experience did the advanced medical rescue holders have?
   A. 9.5 years
   B. 20 years
   C. 10.8 years
   D. over 21 years

8. Select the CORRECT option. What percentage of ECPs were unaware of the potentially life-threatening condition of Ludwig's angina
   A. 55.5%
   B. 14%
   C. 8%
   D. 21%

9. Choose the CORRECT statement. The study confirms that
   A. ECP's have sufficient knowledge and confidence in the management of patients presenting with dental emergencies
   B. ECP's have insufficient knowledge and lack confidence in the management of patients presenting with dental emergencies
   C. ECP's have no knowledge and confidence in the management of patients presenting with dental emergencies
   D. None of the above statements is correct

Traditional and Conservative Molar Endodontic Access Cavity Designs: A Classification and Overview

10. Select the CORRECT answer. According to Clark and Khademi, which of the following describes pericervical dentine best?
    A. 4mm coronal and 6mm apical to the crestal bone
    B. 4mm apical and 6mm apical to the crestal bone
    C. 6mm above and 4mm below the CEJ
    D. None of the above

11. Which of the following is CORRECT. Truss / Ninja access cavities fall within wich of the following access cavity preparation groups?
    A. Ultra-conservative
    B. Conservative
    C. Traditional
    D. None of the above

12. Select the CORRECT option. Which of the following endodontic access cavity designs results in faster endodontic preparation?
    A. Conservative access cavities
    B. Ultra-conservative access cavities
    C. Traditional access cavities
    D. None of the above

In vitro antibacterial activity of three root canal sealers against enterococcus faecalis

13. Which answer is CORRECT. Some areas within the root canal system remain untouched due to:
    A. Apex transportation
    B. Inorganic tissue components
    C. Complexity of the root canal system: isthmi, lateral canals, fins.
    D. Entombment of bacteria

14. Choose the CORRECT option. A prerequisite of endodontic sealers is:
    A. Biofilm formation
    B. Antibacterial activity
    C. Formation of an extracellular matrix
    D. Adaptation to changing oral environment

15. Choose the CORRECT option. Persistent intraradicular colonization of canals is due to:
    A. Mechanical preparation of root canal system
    B. Neutralization of endotoxin
    C. Hermetic fluid-tight seal
    D. Bacteria that resist cleaning and disinfecting of root canals

16. Which of the following is CORRECT. *E faecalis* is isolated in persistent endodontic infections. This may be due to:
    A. The micro-organisms' ability to resist antimicrobial agents and adaptation to the changing environment.
    B. A decreased exhibition zone in root canal systems
    C. Release of hydroxide ions and decrease of pH
    D. Increased host defense mechanisms

What's new for the clinician – summaries of recently published papers

17. Select the CORRECT answer. In the Sharma et al study, having diabetes was associated with a X point drop in OHS compared to no diabetes. X =
    A. 0
    B. 1.7
    C. 3.7
    D. 4.2

18. Which of the following is CORRECT. In the Sharma et al study, which variable was associated with the largest points drop in OHS?
    A. Diabetes
    B. Alcohol intake
    C. Smoking
    D. less than recommended dental attendance

19. Select the CORRECT answer. In the Rothburn et al study, the results suggest that:
    A. GF products contained more calories than the gluten-containing products.,
    B. GF products contained more carbohydrates than the gluten-containing products.
    C. GF products contained more and sugar than the gluten-containing products.
    D. All of the above

20. Which of the following is CORRECT. In the Rothburn et al study, GF products contained X times more sugar than their gluten-containing counterparts. X=
    A. 1.0
    B. 1.1
    C. 1.3
    D. 1.9

Ethics: Misleading advertising – What is our duty as dental professionals towards our patients and the public?

21. Choose the CORRECT answer. Unethical advertising strategies include:
    A. Suggesting advantages of a product without explicitly stating them
    B. Presenting data without providing evidence of the studies
    C. Using subliminal messages and emotive language
    D. All of the above
    E. Only a and b above

22. Which of the following is CORRECT. An adverts that states "Nine out of ten dentists recommends…" is true if:
    A. Ten dentists were surveyed
    B. Ninety percent of those surveyed recommend this product in preference of other similar products
    C. Ninety percent of those surveyed recommend this product, but not exclusively
    D. Both a and c above
    E. Both a and b above

CPD questionnaire

23. Choose the CORRECT answer. An advert that states "Nine out of ten dentists recommends…" may be valid if:
    A. At least 10 dentists were surveyed
    B. A representative sample of dentists were surveyed
    C. There are strict criteria used in the questionnaire which guided the recommendations
    D. Both condition a and c are met
    E. Both condition b and c are met

24. Which answer is CORRECT. Company sponsored research must:
    A. Declare and / or publish both positive and negative results
    B. Make use of researchers who have no conflict of interest
    C. Publish details of the research protocols that were followed
    D. Comply with all of the above
    E. Comply with only with conditions b and c above

25. Select the CORRECT option. It is ethically justified for dentists to not challenge media advertising in case they:
    A. Get sued
    B. Lose out on free samples from that company
    C. Upset colleagues who do support the product
    D. Only a and c above
    E. None of the above

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2. Drafting the work or revising it critically for important intellectual content, AND
3. Final approval of the version to be published, AND
4. Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved (www.icmje.org).

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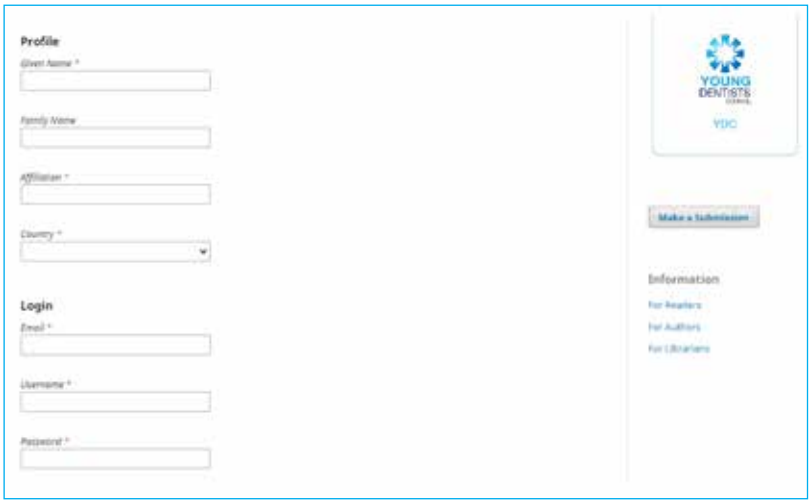

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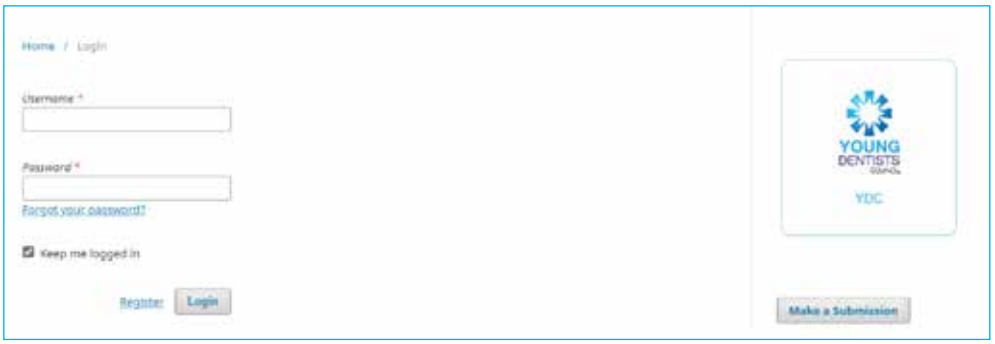

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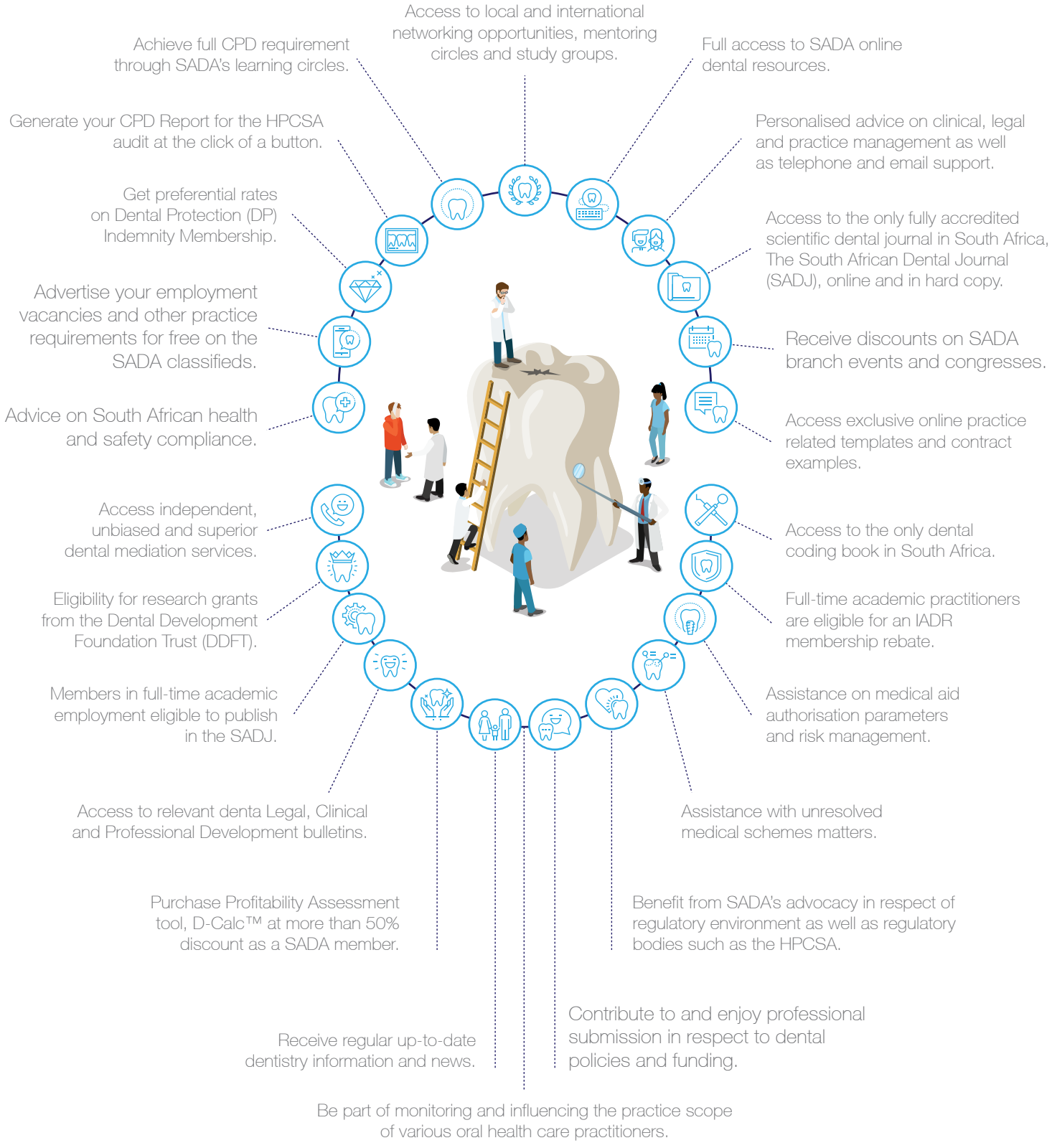

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