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Our Front Cover for this Issue...

Your Fountain of Knowledge

Fountains and springs are a symbol of new hope, vitality, and life. For this reason it was decided to features springs and fountains on the cover pages of the SADJ and use them as an analogy for dentistry and dental education. The first edition of 2022 features one of the world's most iconic and well-known water features, The Fontana di Trevi or Trevi Fountain in Quirinale, Italy. The name is derived from the word Trivium, as it stands at the intersection of three streets. The water will be used to signify knowledge. At the Trevi fountain, it is in plentiful supply and spills over freely to anyone who makes the effort to visit and take a sip. Drinking it will immediately refresh and energise the body and the mind. However, thirst is never sated and as such, visitors will need to constantly seek out new and fresh water supplies, which they may sometimes drink at short and regular intervals, or gulp down in volumes, depending on their thirst. Those who never imbibe, will soon become fatigued dehydrated and will perish.

The Trivium or intersection is symbolic of a meeting of minds. One cannot forever be taking from the fountain without adding back to the pool. The waters may be topped up with a wealth of knowledge coming from various sources, such as research and publications, presentations, discussions, reporting on cases and experiences, and teaching. At the Trevi fountain people add wealth by throwing coins into the water. The legend is that if a coin is cast in, the person will be sure to have further visits to the fountain, as well as safe journeys. Sharing wealth (knowledge) with others also has a beautiful ripple effect. The money is collected each night and given to an Italian charity called Caritas which supports a supermarket that gives rechargeable cards to the needy to help them purchase groceries. We hope that our sharing may also be collected and spread amongst those with a hunger for mental nourishment, growth and education.

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SEFAKO MAKGATHO HEALTH SCIENCES UNIVERSITY

No Longer At Ease

SEFAKO MAKGATHO HEALTH SCIENCES UNIVERSITY

SADJ November 2021, Vol. 76 No. 10 p582-583

Prof Pagollang D Motloba

I thought perhaps I should recite a bit of poetry by William Butler Yeats' called the 'Second Coming', commonly known as 'things fall apart, the centre cannot hold'. The phrase was popularized by Chinua Achebe is his novel "Things Fall Apart" whose title bears the central massage of the work. This poem is a befitting metaphor and an interpretation of what is currently happening in academic, private and public oral health space:

Turning and turning in the widening gyre
The falcon cannot hear the falconer;
Things fall apart; the centre cannot hold;
Mere anarchy is loosed upon the world,
The blood-dimmed tide is loosed, and everywhere
The ceremony of innocence is drowned;
The best lack all conviction, while the worst
Are full of passionate intensity.

Surely some revelation is at hand;
Surely the Second Coming is at hand.

I painfully reminisce about a long an impressive history and reputation that the training of oral health professionals in South Africa and former MEDUNSA, enjoyed. Our graduates were sought after globally and our training the envy of the world. We could vouch without hesitation that we qualified world-class professionals who provided quality oral health service to South Africa. The current state of oral health in the country and SMU is lamentable. I ask myself, how, when, why and where did it all go so wrong? Has management failed to provide leadership and oversight of the academic processes? Is our current crop of academics not equal to the task to deliver on a complex dental curriculum? Are our students university ready? Has our basic education dismally failed to prepare these cohorts for higher education? Are our students teachable or recalcitrant pseudo-militants? Has academia become a fiercely contested space characterised by incursion of politics and erosion of academic autonomy? However, one looks at the present state of dentistry in general, and academic dentistry in particular, we are in dire straits. The centre is not holding, and things are falling apart as the 'widening' gyre, got further and further away from its centre. The falcon has separated from the falconer, without reason, without ruler, without larger cause, it is lost. Yates metaphor of 'loss' and 'falcon' symbolizes the chaos and tragedy that has befallen oral health fraternity; with the individual and collective wandering about and trying to find meaning.

We can all ponder and disagree about how, why, and when did we get to this point. It would be futile to dispute is that over time 'anarchy', and 'bloody' demise was 'loosened' on our beloved profession, taking away what was innocent and pure. Regrettably, the brave watched timidly as the emboldened anarchists ravaged and destroyed without cause, the essence of our profession.


Prof Pagollang D Motloba

The second stanza of the poem, prophesies about the dawning of the new era and the blowing winds of change. This suggests that something altogether different from the current is about to happen. I ask, what kind of second coming should we envisage? What new order should we look forward to? Will this new era be thrust upon us? Then again should we re-imagine, determine and create this new era?

The past 15 years or so indicates the most difficult period for National Oral Health service. The office of the National Health Directorate was hollowed out, repurposed and rendered dysfunctional. Consequently, the capacity and stature of this office to guide oral health in the country was systematically destroyed. Similarly, the importance and influence of the provincial oral health offices have been severely limited. The heads of oral health act as figureheads, de facto provide little or no strategic and governance function for the oral health in the provinces. The combined failure of these structures has collapsed public oral health, if we ever had one. The services provided to our people are mostly dental extractions and nothing else. This is a travesty and disservice to our people, and more should be done.

Training institutions should serve as strategic resource for the country, offering training of the critical human resource of oral health. These centers of excellence must innovate and develop solutions to the country's oral health challenges. The achievement of these institutions in bringing about meaningful changes in oral health have at best been modest. We are yet to conduct a representative national oral health surveys to quantify the oral health burden in the country. This crucial undertaking has been delayed, deferred and postponed due to unnecessary politicking, to the detriment of South Africa. Similarly, a comprehensive, well-consulted national oral health policy remains elusive. Is this monumental failure of dental schools, due to lack of capacity or because the 'centre cannot hold'? Frankly, this points to serious leadership challenges facing dental schools in South Africa.

In the past 6 years, all dental schools in the country were led by acting Deans, as we eagerly awaited the appointment of substantive leaders in these institutions.

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This is attributable in part poor succession planning and development of the next generation of academic leaders for oral health. The same, challenges are evident in the various specialist disciplines as most schools lack the critical experience and talent to populate departments. Recruitment and retention of suitable staff is often an afterthought and not embedded best practice and culture. We 'fail to 'grow our own timber'. One wonders if this state of affairs could explain why none of the dental schools attained full postgraduate accreditation in the past review cycle. Leadership matters.

The Covid-19 pandemic has negatively affected the training of dental students in the past 600 days. Consequently, the prescribed clinical requirements and requisite competency levels could not be achieved due to condensed academic calendar and limited clinical exposure. Thus far, no formal report detailing the impact and implications of the pandemic on oral health training has been produced by the HPCSA. The regulator has no concrete evidence whether the graduates they register to practice meet the gazetted clinical competencies. The HPCSA has not pronounced on the specific clinical, cognitive and affective competencies necessary for registration in this time of Covid-19. In keeping with the mandate "to protect the public and regulate the profession", the gyre of the regulator has widened, turning further and further away from the centre. The oversight role of the HPCSA is not discretionary, yet is has been left to the pleasure of the training institutions. Clearly, governance and oversight is deficient, the best lack conviction, the centre is not holding and things fall apart.

There are ample examples of unfortunate mishaps in dentistry that brought us to this point. Urgent and decisive intervention is necessary to usher the Second Coming. We dare "go gentle in to that good night" We ought to "rage, rage against the dying of the light" ~Dylan Thomas. Full of conviction and passionate intensity ought to choose "not carry thyself down to die", for "when I go to my grave my head will be high "~Bob Dylan.

This piece is meant to raise critical and necessary questions to implore all of us in the Oral Health space to reflect and truly partake in the development of the kind of oral health our country deserves. We cannot sit back and continue to let those that are at the helm of leading the profession fail both the profession and the nation! It certainly behoves all of us to buckle up and get down and dirty to right the wrongs of near past and reshape the profession we want for future generations.

I Write What I Like ~ Steve Bantu Biko

Do the CPD questionnaire on page 649

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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3 Select the CPD navigation tab.
4 Select the questionnaire that you wish to complete.
5 Enter your multiple choice answers. Please note that you have two attempts to obtain at least 70%.
6 View and print your CPD certificate.

A reflection on leadership in academic dentistry

SADJ November 2021, Vol. 76 No. 10 p581

Prof OA Ayo-Yusuf

This reflection is perhaps most appropriate as Sefako Makgatho Health Sciences University (SMU), the youngest University in South Africa, crosses the 5-year mark of its existence. It is a privilege to have served as the first Head of the School of Oral Health Sciences and subsequently as its first Deputy Vice Chancellor for Research, Postgraduate Studies and Innovation. The fact that the school have been in existence for many more years under different institutional arrangements before its incorporation into the new university (SMU) brings unique opportunities and challenges that may not be characteristic of a new dental school nor an existing dental school. It is for this reason that it would require strong, effective leadership at all levels to navigate this uniqueness for the betterment of the school as it continues to offer one of the flagship programmes of the University. At the same time adapting to the ever-increasing demands in the higher education sector, such as 'massification' of higher education and demands from the society, at large.

There are elements of effective leadership in the school as it managed to accredit all its three dental undergraduate programmes over the past five years and more recently its postgraduate programmes. There is a strong element of transformation in leadership at the school, with six out of its nine heads of department being women. Whilst this growth is encouraging, women have not yet achieved parity in opportunity to assume head of school leadership role at SMU, and in South Africa in general. This may reflect on the general pool of potential leaders in academic dentistry, particularly among women. At this point, it is important to reflect on the general need for leadership in academic dentistry, as many of the existing predominantly male senior academics age and retire.

Leadership revolves around having the personality traits that supports effective communication, motivation, inspiration and encouragement, through which leaders inspire individuals. Verma et al.1 described five traits of leaders, which resonates with my experience in leadership, namely analytical interpreter, strategic thinker, team/camaraderie builder, emotional intelligence and commitment to 'Beta Mode' of continuous improvement. In addition to these traits, a leader in academic dentistry must have a well-developed political acumen, which would be important in developing clear, forward-looking vision that is attainable with the often limited resources made available by the University and/or the Provincial Health Department. Dental deans need to acquire these skills not only to effectively respond to innovations and transformational changes in dental education, but also because deans have to commit major parts of the time of academics and students to providing patient care, thereby constraining the time and resources available for research. Yet, research is key to their career advancement.


Prof OA Ayo-Yusuf

Therefore, an academic with leadership skills and previous experience of the complexities and nuances of dental academic centers should be preferred candidate to lead a dental school. With a candidate with good leadership skills, but no previous experience in a dental academic institution, there is a risk of such candidate failing to grasp the importance of the complex interrelationships between education and training, clinical services and oral health research[1]. By implication, it might be strategic for institutions to develop leaders from within its ranks through a well-designed leadership skills training and succession planning.

It is clear that the potential gap in leadership in academic dentistry in general and among women in particular, would require urgent investment in training at all levels of leadership hierarchy, namely frontline leadership, service level leadership and institutional leadership. In particular, for institutional leadership, in addition to acquiring the requisite skills, there is a need to identify appropriate role models and a supportive mentorship programme. There is no doubt that the next phase of growth of the School of Oral Health Sciences at SMU would be better served by investing now in empowering and growing the pool of potential leaders, not only for SMU, but also for academic dentistry in South Africa in general.

Reference

1. Verma M, Wilson NHF, Lynch CD, Nanda A. Leadership in academic dentistry. Journal of Dentistry; 2019; 87; 2-6. Doi:10.1016/j.jdent.2019.05.002

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The Importance of the conduct of Oral Health Research in responding to the Service Delivery Imperatives

SADJ November 2021, Vol. 76 No. 10 p584 - p585

Prof Stephen J H Hendricks

The School of Oral Health Sciences (SOHS) has been the beneficiary of contribution of research projects conducted at various SA Dental Schools in particular with reference to the 2020 International Association for Dental Research (IADR) hosted by SOHS. The quality and standard of the papers delivered resemble the thoroughness and the importance which researchers attach to their work notwithstanding, very heavy clinical responsibilities. The papers will also showcase the variety of research areas that the Faculty is pursuing at present all towards efforts to answer some very difficult research questions that prevail in the clinical domain of service rendering.

The Speakers were of a very high calibre at this first virtual 2020 IADR Conference hosted 12 & 13 November 2020 with guest speakers including: Mr M Muofhe, Deputy Director General (DDG): Technology Innovation, Department of Science and Innovation; Prof N Schellack, SMU Pharmacy School; Mr G Makubalo, SMU Centre for University Teaching and Learning (CUTL); Prof Seekoe, DVC: Teaching Learning & Community Engagement , Prof T Marwala, Vice Chancellor, University of Johannesburg; Hon Deputy Minister Mr BK Manamela: Dep Minister of Higher Education and Training, Prof Ayo-Yusuf, Deputy Vice Chancellor Research, Postgraduate and Innovation; Hon Deputy Minister of Health, Dr Joe Phaahla; Prof SA Karim, SA Clinical Infectious Diseases Epidemiologist; Dr A Glass, Virologist at Lancet; Dr Fundile Nyati: CEO, Proactive Health Solutions; Prof KS Motaung: Founder & Chief Exec Officer, Global Health Biotech; Prof Pablo Vargas: Oral Pathologist, Sao Paulo, Brazil; Dr J vd Walt: Chief Scientist SANEC; Dr Miniggio, Department Oral Maxillo Facial Pathology & Dr Nyalunga, Dentist/Lecturer, Integrated Clinical Dentistry, SOHS.

The purpose of all these research articles is to stimulate a deeper sense of interest in reflecting on exploratory pathways of how to improve the delivery of oral health patient care utilizing the best and most modern technology available and where so require to explore further pathways of how such technology can be improved. The advent of 3D Technology in Oral Health is but at its inception with so many possibilities to enhance the quality of oral health services for improved patient care for our communities. The SOHS prides itself to render the best quality oral health services to the patients at both undergraduate (UG) and postgraduate (PG) level, noting that the Institution is the only public oral health facility located in the central demographic area of Soshanguwe, Garangkuwa, Mamelodi, Mabopane.

Prof Stephen J H Hendricks

The SOHS endeavour to inculcate in especially UG students the importance of the role that contemporary oral health research play in the training in the various fields of oral health in dentistry, oral hygiene and dental therapy. The further advantage that the SOHS has is that it is the only Oral Health School in the country that trains all three disciplines of Dentistry, Oral Hygiene and Dental Therapy at UG level. This advantage lends itself to train oral health professionals in teams based approaches not only in clinical and academic requirements but also in research projects and community outreach engagement. The further advantage that these oral health students experience is that the clinicians that supervise their clinical work and who teaches the online teaching and learning are located both in the public service and in private practice systems. This blend of the 2 systems further enrich the training of the oral health student, bringing to bear research outcomes in both systems, through which the students are exposed to new or improved techniques of services care delivery which practitioners have perfected in the private practice though rendered within the framework of the UG and PG curriculum.

The very highly specialised field of dentistry provides to the students with inquiring minds several options for further UG and PG research in the School. A further indicator is the number of academic staff who are pursuing further academic studies which involves research components where many of them are supervising students and can therefore respond to research questions that emerge at the dental chair side when patients are treated. In seeking to deliver the best type of oral health care there is an ongoing need to continuously seek new ways of improving service delivery so that in the end patients are satisfied with the oral health care received which should always be of the highest order of quality. This will entail that the student

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at their respective levels of training are very competent and that such competence are subjected to new research undertakings to improve the quality of care the patients receive.

The National Tertiary Service Grant (NTSG) has provided though very much limited funding for equipment that is used in the clinical training of UG and PG Students. Such equipment enhances the conduct of research so that better ways are explored to render optimal oral health care to patients. There is also the Clinical Training Grant (CTG) which provides both additional trained oral health personnel who can supervise both clinical training and research as well as equipment which can further enhance research training. This also involves the Dental Laboratory as a support service for student in training and the acquiring of computer-aided design and computer-aided manufacturing (CADCAM) equipment opens up several new areas of research possibilities.

One of the areas of research we need to explore further is the conduct of research by Postgraduate Student especially registrars. These students are required to complete a mini-dissertation (research report) and a publishable paper but as was reported often there time factor is the challenge to conduct such research. Departments are exploring efforts to address this matter because through such research projects new research questions are generated which can further improve the service delivery provided by these PG students. The SOHS Research Committee is endeavouring to push for greater research output as demonstrated by the published papers over the last 12 months notwithstanding the challenges brought about by the Covid 19 pandemic, which precluded the conduct of research both Quantitative and Qualitative in accessing research subjects for the require information.

An area for further research exploration is the impact of OTL on the academic enterprise in particular that there is a greater requirement for self actualization learning by students and less class contact with lecturers. One of the drawbacks has been the support technology required for optimum learning and teaching as well as for assessments which have in part failed the system introduced by the University. The merits of the OTL may be generally very good but the implementation at our University has not been without challenges which lead to academic having less confidence in the outcome results of students. It is hoped that the University will invest more funding in this domain for high quality research to improve the OTL system to the benefit of both the students and the educators.

In conclusion, the vast area of dental research has contributed enormously to the field of dentistry, oral hygiene and dental therapy but more needs to be done in the field of oral health research so that the return on investment in higher education is commensurate with the expectations of high standard and quality education in the oral health in South Africa.

Best Wishes!

- to SMU from SADA and the SADJ

SADJ November 2021, Vol. 76 No. 10 p586

A birthday is the anniversary of the birth of a person, or figuratively of an institution. Birthdays are celebrated in numerous cultures, often with birthday gifts, birthday cards, a birthday party, or a rite of passage.

Birthdays are very significant in people's lives because they signify growth and maturity. Many religions celebrate the birth of their founders or religious figures with special holidays (i.e., Christmas, Mawlid, Buddha's Birthday, and Krishna Janmashtami).

In the academic space "Birthdays" can be celebrated with, amongst many forms, a Festschrift.

A Festschrift contains original contributions by the honoured academic's close colleagues, often including their former doctoral students. It is typically published on the occasion of the honouree's retirement, significant birthday, or another notable career anniversary. A Festschrift can be anything from a slim volume to a work in several volumes.

This year the SADJ is celebrating the Sefako Makgatho Health Science University (SMU) as it celebrates FIVE years since its inauguration. Five years is known as the wood anniversary - Wood symbolizes strength of a bond. Wood is durable and long-lasting, indicating a solidified relationship. In this case this would be the relationship that SMU has formed with many stakeholders including with SADA. Although 5 years seems very infantile, SMU bears a very rich history as an institution because it was formed from a very momentous institution in the history of the Republic of South Africa and Africa. Having produced some of the African giants in the discipline of Health Sciences and continuing to do so through this new institution.

The original history of the institution can be traced back to 1976 however this new university was formed on 1 January 2015 and this year they decided to celebrate this revolutionary occasion, as we all know that there is a distinction between birthday and birthdate.

The SADJ and SADA would like to congratulate SMU on this milestone and wish them all the best for the many more years to come as they continue to produce professionals (undergraduate and post-graduate) that will make a meaningful contribution to society. We would like to thank all the academics for the meaningful contributions to the SADJ, through the managing editor, editorial team and the authors without these contributions the SADJ would never be published in the manner that it does and with such rich content. SADA has also worked very closely with some academic staff members from SMU to provide some continuous professional development programs to the oral health practitioners, which is a legislative requirement by the HPCSA to ensure ethical, good and most current service provision to patients, for that we are eternally grateful.

In line with the mission of the university to "Provide high-quality primary health care-oriented health sciences research, education and services. Produce a cadre of health professionals with the transformative leadership capacity to identify, analyse and address the health needs of the individual, the family, the community and the population." We would like to pledge our support and solidarity to the university in ensuring that this is a mission that is achieved, because the good health of our society counts on it.

Moving forward we hope to strengthen our relations for the betterment and progression of the oral health profession and health in general.

Happy birthday!!! SADA hopes all the university's birthday wishes and dreams come true.

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Future plans of final-year dental therapy students at Sefako Makgatho Health Sciences University

SADJ November 2021, Vol. 76 No. 10 p587 - p592

MM Masetla[1], SR Mthethwa[2]

ABSTRACT

Introduction

The distribution and accessibility of healthcare professionals as well as the quality of healthcare services that the healthcare system is able to deliver are significantly affected by the choices of the medical and other health science graduates.

Aims and objectives

To describe the career and practice intentions of final-year dental therapy students' classes of the years 2017 and 2018 at Sefako Makgatho Health Sciences University

Design

A cross-sectional survey.

Methods

A structured, closed, self-administered, questionnaire was used to collect data. Data related to demographic characteristics, work preferences and career intentions were acquired and then captured in Microsoft excel software.

Results

Female students constituted the majority (54.05%). The average age of the population was 23 years old. 64.86% of the students preferred to work in the public sector. A little more (18.9% vs 13.5%) students had been offered jobs than had applied. Twice as many (54.05% vs. 27.03%) preferred to work in the Gauteng province as the percentage who resided there. No fewer than 59.46% saw themselves owning private practices in five years' time.

Conclusion

The majority of students preferred to work in the public sector after graduating with the intention of owning a private practice in the medium term.

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1. **Modjadji Mary Masetla:** Conception; design; acquisition of data - 50%
2. **Sibusiso R Mthethwa:** Conception; design; acquisition of data; analysis and interpretation of data; drafting the article - 50%

INTRODUCTION AND BACKGROUND

The distribution and accessibility of healthcare professionals as well as the quality of healthcare services that the healthcare system is able to deliver are significantly affected by the choices of the medical and other health science graduates.[1] There is severe shortage and maldistribution of oral health personnel in South Africa. The size of the oral health personnel, which includes dental assistants, oral hygienists, dental therapists, and dentists, has been estimated to be 0.2 per 1000 population.[2] An overwhelming majority of oral health professionals work in the private sector.[3] There is an imbalance in the geographic distribution of oral health personnel favouring large urban areas.[3,4] There are several possible explanations for the maldistribution of dental therapists. Chief among them is the lack of posts and poor salaries in the public sector.[5] Others include the lack of academic growth (career pathing).[6] These factors may account for the high attrition experienced in the profession of dental therapy. A number of studies have found that a significant proportion of dental therapists go on to pursue other careers or study dentistry.[7,8] These findings are rather unfortunate since the profession of dental therapy has long been held up as a model for reducing access to care barriers in high-risk underserved populations worldwide.[9-11] The structural ills of the health system which necessitated the founding of the dental therapy profession in South Africa have not been adequately corrected. These consists of, among others, a shortage and inequitable distribution of oral health personnel,[3,12-14] lack of dental services at primary health care level,[15] high attendance rates where services were available and accessible,[16,18] and limited range of services offered.[18]

In South Africa, dental therapy training is currently offered at the dental schools of the universities of KwaZulu-Natal and Sefako Makgatho Health Sciences University. The combined overall mean number of dental therapy graduates produced annually is a little less than thirty.[8,19] A meagre dental therapist to population ratio of 0.13 per 10,000 has been estimated.[20] The low numbers of dental therapist in training coupled with the maldistribution of professionals militate against the profession's capability for reducing access to care barriers.

The urgent need to train a great many dental therapists to alleviate the shortage of oral health personnel has long been recognised.[21] The human resource plan of the National Department of Health envisaged an increased annual output of 600 dental therapists from a baseline of 25.[22] An argument has recently been made that we should be training fewer dentists and more oral hygienists and dental therapists.[5] This line of reasoning is supported by evidence emerging from epidemiological studies of disease burden.

Evidence indicates that dental caries is the most prevalent oral disease[23] - the latest national survey found that more than 80% of dental caries in children was untreated.[24] New oral health priorities, which include conditions such as periodontal disease, oral manifestations of HIV/AIDS, dental trauma, oral cancer and craniofacial anomalies, have arisen.[25,26] The imbalance in the geographic distribution of oral health personnel warrants a survey of the future plans of dental therapy graduates. The current study, which was part of a larger study which examined trends in enrolments, examination pass rate and graduations of dental therapy student cohorts at Sefako Makgatho Health Science University during the period 2004 to 2014,[19] describes future plans of the 2017 and 2018 cohorts of dental therapy students in the final year of study.

OBJECTIVE OF THE STUDY

To describe the demographic characteristics, work preferences and career intentions of final-year dental therapy students'

Table 1: Demographic characteristics

Age in years	2017 class			2018 class		
	Female n (%)	Male n (%)	Total n (%)	Female n (%)	Male n (%)	Total n (%)
20	2 (25)	0 (0)	2 (12.5)	5 (41.67)	1 (11.11)	6 (28.57)
21	1 (12.5)	1 (12.5)	2 (12.5)	3 (25)	2 (22.22)	5 (23.81)
22	3 (37.5)	2 (25)	5 (31.25)	0 (0)	1 (11.11)	1 (4.76)
23	1 (12.5)	1 (12.5)	2 (12.5)	1 (8.33)	2 (22.22)	3 (14.29)
24	0 (0)	0 (0)	0 (0)	2 (16.67)	1 (11.11)	3 (14.29)
25	1 (12.5)	2 (25)	3 (18.75)	1(8.33)	0 (0)	1 (4.76)
26	0 (0)	1 (12.5)	1 (6.25)	0 (0)	0 (0)	0 (0)
27	0 (0)	0 (0)	0 (0)	0 (0)	1 (11.11)	1 (4.76)
29	0 (0)	1 (12.5)	1 (6.25)	0 (0)	0(0)	0 (0)
30	0 (0)	0 (0)	0 (0)	0(0)	1 (11.11)	1(4.76)
Total n (%)	8 (100)	8 (100)	16 (100)	12 (100)	9 (100)	21 (100)

The total number of students in the 2018 class was 23.8% higher than that in the 2017 class. The average age and standard deviation of the classes were similar [23 years SD = 2.422 (2017) vs. 22.38 years SD = 2.636 (2018)] Gender parity was observed in the 2017 class. In contrast, female students constituted the majority (57.14%) in the 2018 class.

Table 2: Person or institution responsible for paying study fees

Cohorts	Person or institution responsible for paying study fees					
	DOH n (%)	NSFAS n (%)	Other n (%)	Parents n (%)	Self n (%)	Total n (%)
2017	4 (66.66)	5 (25)	1 (50)	4 (57.14)	2 (100)	16 (43.24)
2018	2 (33.33)	15 (75)	1 (50)	3 (42.86)	0 (0)	21 (56.76)
Total n (%)	6 (100)	20 (100)	2 (100)	7 (100)	2 (100)	37 (100)

DOH – Department of Health; NSFAS - National Student Financial Aid Scheme

DOH – Department of Health; NSFAS - National Student Financial Aid Scheme
An equal (25%) proportion of students in the 2017 class had their study fees paid either by the Health Department or their parents. None of the students in the 2018 class were personally responsible for paying their fees. In fact, the National Student Financial Aid Scheme (NSFAS) paid the fees for 71.43% of them.

Table 3: Province of residence

Province	2017 class n (%)	2018 class n (%)	Total n (%)
Eastern Cape	1 (6.25)	0 (0)	1 (2.7)
Gauteng	5 (31.25)	5 (23.81)	10 (27.03)
KZN	2 (12.5)	2 (9.52)	4 (10.81)
Limpopo	6 (37.5)	10 (47.62)	16 (43.24)
Mpumalanga	1 (6.25)	4 (19.05)	5 (13.51)
North West	1 (6.25)	0 (0)	1 (2.7)
Total n (%)	16 (100)	21 (100)	37 (100)

Students came from six of the nine provinces of the country. The provinces of Limpopo and Gauteng together contributed the bulk (70.27%) of students.

Table 4: Preferred province for work			
Preferred province	**2017 class n (%)**	**2018 class n (%)**	**Total n (%)**
Any province	0 (0)	2 (9.52)	2 (5.41)
Gauteng	11 (68.75)	9 (42.86)	20 (54.05)
KZN/ Gauteng	1 (6.25)	0 (0)	1 (2.7)
Limpopo	2 (12.5)	4 (19.05)	6 (16.22)
Limpopo/Gauteng	0 (0)	1 (4.76)	1 (2.7)
Mpumalanga	1 (6.25)	4 (19.05)	5 (13.51)
Mpumalanga/Gauteng	0 (0)	1 (4.76)	1 (2.7)
North West	1 (6.25)	0 (0)	1 (2.7)
Total n (%)	16 (100)	21 (56.8)	37 (100)
More than two-thirds (68.75%) of students in the 2017 class intended to work in Gauteng compared with 42.86% of students in the 2018 class. Limpopo was the second most preferred province for work by students from both cohorts.			

Table 5: Preferred job sector			
Job sector	**2017 class n (%)**	**2018 class n (%)**	**Total n (%)**
Don't know	0 (0)	3 (14.29)	3 (8.11)
Private practice	4 (25)	3 (14.29)	7 (18.91)
Public sector or Private practice	1 (6.25)	1 (4.76)	2 (5.41)
Public sector	11 (68.75)	13 (61.9)	24 (64.86)
University	0 (0)	1 (4.76)	1 (2.7)
Total n (%)	**16 (100)**	**21 (100)**	**37 (100)**
The majority (68.8% vs 61.9%) of students from both classes planned to work in the public sector. A lone student in the 2018 class intended to work at a university.			

Table 6: Number and percentage of students searching for a job			
Applied for a job	**2017 class n (%)**	**2018 class n (%)**	**Total n (%)**
No	11 (68.75)	21 (100)	32 (86.5)
Yes	5 (31.25)	0 (0)	5 (13.5)
Total n (%)	**16 (100)**	**21 (100)**	**37 (100)**
A little less than a third (31.25%) of students in the 2017 class had applied for a job. In contrast, none of the students in the 2017 class had applied for a job.			

Table 7: Number and percentage of students with job offers			
Job offer	**2017 class n (%)**	**2018 class n (%)**	**Total n (%)**
No	11 (68.75)	19 (90.5)	30 (81.1)
Yes	5 (31.25)	2 (9.5)	7 (18.9)
Total n (%)	**16 (100)**	**21 (100)**	**37 (100)**
A little less than a third (31.25%) of students in the 2017 class had received job offers compared with 9.5% of students in the 2018 class.			

classes of the years 2017 and 2018 at Sefako Makgatho Health Sciences University.

MATERIALS AND METHODS

Design

This was a cross-sectional survey.

Target population

The study population consisted of final-year classes of dental therapy student enrolled at Sefako Makgatho Health Sciences University between the years 2017 and 2018.

Study sample

Only students who provided informed consent were enrolled – as it turned out, all students were recruited.

MEASUREMENTS

Questionnaire

A structured, closed, self-administered, questionnaire was used to collect data. Data related to demographic characteristics and career and practice intentions were acquired and then captured in Microsoft excel software.

Ethical considerations

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

STATISTICAL ANALYSIS

Data was captured, coded and cleaned in Microsoft excel software and then transferred to Statistical Package for the Social Sciences (SPSS) software for analysis. Means, frequencies and proportions (percentages) were calculated.

RESULTS

Data of a population of 37 dental therapy students was analysed. A response rate of 100% was achieved. No fewer than 59.46% of the population saw themselves

Table 8: Number and percentage of students intending to study dentistry			
Intend to study dentistry	**2017 class n (%)**	**2018 class n (%)**	**Total n (%)**
No	12 (75)	17 (81)	29 (78.3)
Yes	4 (25)	4 (19)	8 (21.6)
Total n (%)	**16 (43.2)**	**21 (56.8)**	**37 (100)**
One out of five students in the population intended to study dentistry.			

Table 9: Medium term career intentions			
Career intentions	**2017 class n (%)**	**2018 class n (%)**	**Total n (%)**
No medium term plans	0	1 (4.76)	1 (2.7)
Own a practice	9 (56.25)	13 (61.9)	22 (59.46)
Undecided between owning a practice and pursuing postgraduate studies	1 (6.25)	2 (9.52)	3 (8.11)
Pursue postgraduate studies	2 (12.5)	2 (9.52)	4 (10.81)
Study dentistry	2 (12.5)	1 (4.76)	3 (8.11)
Study medicine	0	1 (4.76)	1 (2.7)
Study pharmacy	1 (6.25)	0	1 (2.7)
Work in the public sector	1 (6.25)	1 (4.76)	2 (5.41)
Total n (%)	**16 (100)**	**21 (100)**	**37 (100)**
No fewer than 59.46% of the population saw themselves owning private practices in stark contrast to 5.41% who saw themselves working in the public sector in five years' time. A handful (13.51%) of students saw themselves changing careers and studying either dentistry, medicine or pharmacy.			

owning private practices in stark contrast to 5.41% who saw themselves working in the public sector in five years' time. A handful (13.51%) of students saw themselves changing careers and studying either dentistry, medicine or pharmacy.

DISCUSSION

This study set out to survey the future plans of final-year dental therapy students' classes of the years 2017 and 2018 at Sefako Makgatho Health Sciences University. A response rate of 100% was obtained.

Demographic characteristics

The size of the student population in the current study was 37 i.e. 16 and 21 students in the 2017 and 2018 classes respectively (Table 1). These somewhat improved results differ from those of an earlier study by Masetla and Mthethwa (2018) who found that the median number of third year enrolees during the decade between 2004 and 2014 was 13 with an interquartile range of 9 to 15.[19]

The results of this study indicate that female students constituted the majority (54.05%) (Table 1). The present findings seem to be consistent with other research which found that female students constitute the majority of dental therapy students.[8,19]

The current study found that the average age of the students was 23 years old (Table 1). This finding does not support the previous research. The analysis of a decade-long (2001 to 2010) data of dental therapy students' enrolment at the University of KwaZulu-Natal by Singh and Combrinck found that all students on entrance were under 20 years of age.[8]

Person or institution responsible for paying study fees

The results of this study show a significant increase (31.25% vs 71.43%) in the proportion of students who relied on NSFAS to pay for theirs studies between the years 2017 and 2018 (Table 2). This finding was unexpected, considering the fact free higher education for new first year students from families that earn less than R350 000 per year was only introduced in 2018.[27]

Province of residence

The results of this study show that the bulk (70.27%) of students came from the provinces of Limpopo and Gauteng (Table 3). The province of Limpopo was overrepresented in the student population of the current study. The province of Gauteng, the home province of Sefako Makgatho Health Sciences University, shares borders with the provinces of Mpumalanga, Limpopo and North West.

Preferred province for work

The most interesting finding was that twice as many (54.05% vs. 27.03%) students preferred to live and work in the Gauteng province as the percentage who resided there (Tables 3 and 4). The present findings seem to be consistent with other research which found that dental care professionals are concentrated in urban areas.[3,4] Gauteng is the most urbanised province in South Africa – 94% of the population lives in urban areas.[28]

Another important finding was that a little more than a third (37.5%) of students from Limpopo preferred to work in Limpopo (Tables 3 and 4). These results differ from those of Naidu and Diab (2013) who found that health science students of rural origin were significantly more likely to prefer working a rural area than their urban-origin counterparts.[1] Limpopo has the highest rural profile of all provinces in South Africa. It is unfortunate that students were not asked to classify their homes as being situated in an urban or rural area in the current study.

It would seem that the area of location of the training institution has an influence on the choice of area of practice of the graduates. These findings are rather disappointing as they suggest that redressing the rural-

urban dentist-patient ratio imbalance in South Africa will remain a pipedream.

Preferred job sector

It is interesting to note that a little less than two-thirds (64.86%) of the students preferred to work in the public sector (Table 5). These results do not support the previous research. Singh and Combrinck (2011) found that the percentage of graduates over the period from 2001 to 2010 from the University of KwaZulu-Natal in the public sector showed a steady decrease from a maximum of 35% in 1985 to 10% in 2000. From 2000 onwards this percentage stayed more or less the same, fluctuating around a mean of 9.5%.[8] These findings suggest that the students are either altruistic or are undeterred by the challenges prevailing in the public sector. Poor job satisfaction among dental therapists in the public sector has been reported.[29] Several possible explanations for the dissatisfaction have been put forward. These include among others the lack of posts, lack of status and promotion potential, poorly functioning dental facilities, and inadequate remuneration.[5,29]

Comparison of the percentage of students who had received job offers with those who had applied

The results of this study indicate that a little more (18.9% vs 13.5%) students had been offered jobs than had applied (Tables 6 and 7). It is not unreasonable to assume that the students who had received job offers were the one and the same as those who had received financial assistance for their studies from the department of health - the health department was liable for the payment of university fees for 16.2% of students. The low percentage of students with job offers is very concerning for the reason that data for the current study was collected towards the end of the second semester.

Number and percentage of students intending to study dentistry

The results of this study indicate that one out of five students intended to study dentistry (Table 8). These findings are consistent with those of Singh and Combrinck (2011) who found that the percentage of the University of KwaZulu-Natal graduates who went on to study dentistry showed a steady decrease up to 1993. From 1993 onwards it stayed more or less the same, fluctuating around a mean of 19%.[8] The decline in 1992 coincided with the introduction of private practice for dental therapists.[30] The findings of the current study confirm the widely held belief that many dental therapists chose this profession as a stepping stone to dentistry. The assertion by the former dean of the two dental schools training therapists cited in the study by Singh (2014) that almost one-third of the first-year dentistry class of 2009 were qualified dental therapists lends further support to this belief.[29] The former dean must have been referring to the University of Limpopo (Medunsa Campus), the predecessor of Sefako Makgatho Health Sciences University, since the University of KwaZulu-Natal does not train dentists. The findings of the current study must however be interpreted with caution since the practice patterns of graduates of Sefako Makgatho Health Sciences University and its predecessor institutions have not previously been described.

The most interesting finding was that the responses of students to the question about their intentions to study dentistry contrasted sharply with their responses to the question about where they saw themselves in five years' time. One out of five students intended to study dentistry compared with 8% who saw themselves studying dentistry in five years' time (Tables 8 and 9). It is difficult to explain these rather contradictory results.

Medium term career intentions

It is interesting to note that 59.46% of the students saw themselves owning private practices in stark contrast to the 5.41% who saw themselves working in the public sector in five years' time (Tables 9). This combination of findings, though somewhat higher for those who saw themselves owning private practices in the current study, is consistent with those of Singh and Combrinck (2011) who found that the percentage of University of KwaZulu-Natal graduates in private practice between the years 1994 and 2010 has fluctuated around a mean of 47%. Furthermore, they found that the percentage of students in the public sector has fluctuated around a mean of 9.5% between the years 2000 and 201.[8] The results of the current study were not very encouraging. The very low percentage (5.41%) of students who saw themselves working in the public sector in five years' time is extremely concerning. It suggests that until such time that dental therapists sense that the widely publicized shortcomings of the public service have been addressed, the high turnover rate experienced in the public service sector will continue. Seeing that 59.46% of the students saw themselves working in the public sector in five years' time, it would be interesting to find out if they were aware of the challenges of private practice. The frustrations experienced by dental therapists with their limited scope in private practice have been documented. Singh (2014) concluded that the roles and scope of all members of the oral health team needs to be redefined within the context of the primary health care approach.[29]

The results of this study show that students have varied career aspirations. The motivation for choosing dental therapy as a career is an important issue for future research.

Limitations of the study

The potential threat to the internal validity of the study was that arising from the challenge of coding the responses to the open-ended question - where do you see yourself in five years?

CONCLUSION

The majority of students preferred to work in the public sector after graduating with the intention of owning a private practice in the medium term.

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Throughputs of oral hygiene programmes offered at Sefako Makgatho Health Sciences: a retrospective comparison

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ABSTRACT

Introduction
The expansion of the scope of practice of the profession of oral hygiene necessitated the discontinuation of a two-year diploma programme.

Aims and objectives
To describe and compare the progress to qualification of three cohorts of oral hygiene students enrolled in the diploma and degree programmes at Sefako Makgatho Health Science University. Trends in throughputs were investigated.

Design
A comparative cross-sectional study.

Methods
Academic records of three cohorts of first year oral hygiene students enrolled in the diploma and degree programmes were followed up. Data related to the demographic characteristics, numbers enrolled, numbers who dropped out, and the numbers who graduated were acquired and then captured in Microsoft Excel software.

Results
There was gender parity in enrolment for the diploma programme. Female students constituted the majority of enrolees for the degree programme. The average first year pass rate (83.8% vs 75.8%) as well as average throughput (62.5% vs 56.1%) of the degree programme was higher than that for the diploma programme. Linear trends between cohort size and throughput were not observed. The difference in combined output between the programmes was not statistically significant.

Conclusion
The average throughput of the degree programme was higher than that for the diploma programme

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2. **Author 2:** conception; revising the article critically for important intellectual content
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INTRODUCTION AND BACKGROUND

The time it takes to qualify as an oral hygienist at the Oral Health Centre of Sefako Makgatho Health Sciences University, a dental school and referral hospital in Garankuwa on the outskirts of Pretoria changed significantly in 2014 when a two-year diploma, which had been offered since the mid-1970s, was discontinued in favour of a three-year degree. This change was in line with the government gazetted expansion of the scope of practice.[1] The degree programme in oral hygiene is currently offered at the Dental Schools of the University of the Western Cape (UWC), University of KwaZulu-Natal (UKZN), University of the Witwatersrand (Wits), Sefako Makgatho Health Sciences University (SMU) and University of Pretoria (UP). A total of 342 students were enrolled at the five dental schools in the year 2020.[2] This figure does not give an indication of the students' progress to degree.

The throughput, also referred to as the completion rate or graduation rate[3], of oral hygiene programmes at the five dental schools has not previously been described. The results of such a study could be useful to policy-makers in developing human resources plan for oral health and to dental schools' management in identifying impediments to graduation in order to offer the necessary academic and mentoring support to enable success should there be a need. The throughputs of the dentistry and dental therapy courses at SMU have recently been established. They were found to be 40% and 45% respectively.[4,5] These findings are not very encouraging. They indicate that less than half of all students registered in either programme graduated within the regulation time. This is unfortunate as oral health personnel, including dental assistants, oral hygienists, dental therapists, and dentists, have been estimated to constitute 0.2 per 1000 population.[6]

Oral hygienists are indispensable members of oral health care teams. The Health Professions Council of South Africa

(HPCSA) defines oral hygienists as "health professionals devoted to the prevention of diseases and the promotion and improvement of the public's health".[7] Oral hygienists work in a range of dental settings, from general private practice, specialised private practice, state health, or lecturing in the various training institutes across the country.[8] They can also work in residential aged care facilities.[9,10] A significant majority of oral hygienists are employed in private practice.[11] Surprisingly, the number of oral hygienists employed in the public sector increased steadily from 127 to 194 between 2002 and 2010.[12] One thousand two hundred and fifty-seven oral hygienists are currently registered with the HPCSA.[2] The analysis of public sector data has established the oral hygienist to population ratio to be a meagre 0.04 per 10,000.[12]

In light of the statistics, a study of the contribution of SMU oral hygiene programmes towards the oral health personnel needs of the country is warranted.

OBJECTIVES OF THE STUDY

To describe the demographic characteristics and track and compare the progress to qualification of three cohorts of first year oral hygiene students enrolled in the diploma and degree programmes. To describe a trend in the throughputs of the diploma and degree programmes.

MATERIALS AND METHODS

Study design

This was a retrospective, comparative cross-sectional study in which existing academic records were reviewed.

Target population

The sampling frame consisted of academic records of oral hygiene students who were enrolled in the diploma and degree programmes at Sefako Makgatho Health Sciences University during the period 2011 to 2014 i.e. academic records of three cohorts of first year oral hygiene students enrolled in the diploma and degree programmes for the calendar years 2011 through 2013 and 2012 through 2014 respectively were followed up.

Study sample

Every available record was studied

Data collection

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

Definition of variables and terms

Gender refers to student sex as recorded in the academic records. Population group breakdown of students into Black, Indian, Coloured and White was applied according to the Population Registration Act of 1950.[13]

Progress to qualification refers to enrolment and academic progress. Regulation time is the period of time normally expected for completion of the qualification i.e. two years for a diploma vs three years for a degree.

Throughput is how many students who started studying complete the course of study. This may also be measured by the number of students who do not drop out.[14] It is also referred to as the completion rate, or graduation rate.[3] First-timer refers to a student who was enrolled in a year of study for the first time.

Ethical considerations

Ethical approval for the study was granted by the Ethics Committee of Sefako Makgatho Health Sciences University (SMREC/D/198/2019). Permission to conduct the study was granted by the Chief Executive Officer (CEO) of the Oral Health Centre.

Table 1: Gender distribution by programme type

Gender	Programmes		Total n (%)	Chi-Square Test
	Diploma (calendar years 2011 through 2013) n (%)	Degree (calendar years 2012 through 2014) n (%)		
Male	15 (50)	11 (39.3)	26 (44.8)	
Female	15 (50)	17 (60.7)	32 (55.2)	.412
Total	30 (100)	28 (100)	58 (100)	

The number of students enrolled in both programmes during calendar years 2011 through 2013 was almost similar (30 vs 28). There was gender parity in enrolment for the diploma programme. More female students than male students (60.7% vs 39.3%) were enrolled in the degree programme. The difference in gender distribution between the programmes was not statistically significant (p = 0.412)

Table 2: Racial composition by programme type

Race	Programmes		Total n (%)
	Diploma (calendar years 2011 through 2013) n (%)	Degree (calendar years 2012 through 2014) n (%)	
Black	29 (96.7)	28 (100)	57 (98.3)
Indian	0 (0)	0 (0)	0 (0)
White	1 (3.3)	0 (0)	1 (1.7)
Total	30 (100)	28 (100)	58 (100)

Black students constituted an overwhelming majority (96.7%) of the enrolees in the diploma programme. All students enrolled in the degree programme were Black.

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-square tests were performed to test the statistical significance of the differences in proportions. Chi-square tests for trend were performed to investigate trends in the throughputs of the diploma and degree programmes. The chosen significance level of the tests was a p-value less than 0.05.

Results

Academic records of three cohorts of first year oral hygiene students enrolled in the diploma and degree programmes for the calendar years 2011 through 2013 and 2012 through 2014 respectively were followed up and analysed.

Discussion

This study set out to determine the contribution of the oral hygiene programs of SMU towards the oral health personnel needs of the country. The progress to qualification of three cohorts of first year oral hygiene students enrolled in the diploma and degree programs was tracked and compared. Trends in the throughputs of the programs were also determined.

Demographic characteristics

The results of this study indicate that the number of students enrolled in both programmes during calendar years 2011 through 2013 was similar (Table 1). It is difficult to explain this result, but it might be related to the limit in the maximum number of students that can register in the course.

The current study found that female students constituted the majority of enrolees for the degree programme (Table 1). The present findings seem to be consistent with other research which found that female students comprise the majority of students in the oral health sciences.[15,16]

The results of this study show that Black students constituted an overwhelming majority (96.9%) of the enrolees (Table 2). This finding is in keeping with the legacy of SMU predecessor institutions. Medunsa, the Medical University of Southern Africa, was founded in 1976 to address both the under-representation of blacks in the health professions and the lack of good health care in the homelands. The university trained most of the black physicians, dentists, veterinarians, and allied health professionals in South Africa.[17]

The current study found that first-timers constituted 85.7% and 76.7% of the enrolees for the degree and diploma

Table 3: Numbers of first-timers by programme type

First-timers	Programmes		Total n (%)	Chi-Square Test
	Diploma (calendar years 2011 through 2013)	Degree (calendar years 2012 through 2014)		
Yes	23 (76.7)	24 (85.7)	47 (81)	
No	7 (23.3)	4 (14.3)	11 (19)	.380
Total	30 (100)	28 (100)	58 (100)	

First-timers constituted 85.7% and 76.7% of the enrolees for the degree and diploma programmes respectively. The difference in proportions (85.7% vs 76.7%) of first-timers between the programmes was however not statistically significant (p = 0.380).

Table 4: Pass rates for first year diploma students across levels of cohorts

Cohorts	Examination Results		Total n (%)	Fisher's Exact Test
	Pass	Fail		
2011	12 (85.7)	2 (14.3)	14 (100)*	.000
2012	9 (75)	3 (25)	12 (100)	
2013	2 (66.7)	1 (33.3)	3 (100)	
Total	23 (79.3)	6 (20.7)	29 (100)*	

*Number of students that interrupted studies

The average pass rate among cohorts of first year diploma students was 75.8% with a range of 66.7% to 85.7%. There was substantial evidence (p = 0.000) to reject the null hypothesis that the pass rate was constant across levels of cohorts

Table 5: Pass rates for second year diploma students across levels of cohorts

Cohorts	Examination Results		Total n (%)	Fisher's Exact Test
	Pass	Fail		
2011	9 (81.8)	2 (18.2)	11 (100)*	.000
2012	5 (62.5)	3 (37.5)	8 (100)*	
2013	2 (100)	0 (0)	2 (100)	
Total	16 (76.2)	5 (23.8)	21 (100)**	

*Number of students that dropped out

The average pass rate among cohorts of second year diploma students was 81.4% with a range of 62.5% to 100%. There was substantial evidence (p = 0.000) to reject the null hypothesis that the pass rate was constant across levels of cohorts. Two out of thirty (6.7%) students who started the course dropped out.

Table 7: Pass rates for second year degree students across levels of cohorts

Cohorts	Examination Results		Total n (%)	Fisher's Exact Test
	Pass	Fail		
2012	4 (80)	1 (20)	5 (100)	.000
2013	5 (83.3)	1 (16.7)	6 (100)**	
2014	9 (100)	0 (0)	9 (100)**	
Total	18 (90)	2 (10)	20 (100)****	

* Number of students that dropped out

The average pass rate among cohorts of second year degree students was 87.8 with a range of 80% to 100%. There was substantial evidence (p = 0.000) to reject the null hypothesis that the pass rate was constant across levels of cohorts. Four out of twenty-eight (14.3%) students who started the course dropped out.

Table 8: Pass rates for third year degree students across levels of cohorts

Cohorts	Examination Results		Total n (%)	Fisher's Exact Test
	Pass	Fail		
2012	4 (100)	0 (0)	4 (100)	.000
2013	5 (100)	0 (0)	5 (100)	
2014	9 (100)	0 (0)	9 (100)	
Total	18 (100)	0 (0)	18 (100)	

The average pass rate among cohorts of third year degree students was 100%. There was substantial evidence (p = 0.000) to reject the null hypothesis that the pass rate was constant across levels of cohorts

Table 9: Trend in throughput for the diploma programme

Completed the course in regulation time	Cohorts			Chi-Square test for trend
	2011 n (%)	2012 n (%)	2013 n (%)	
Yes	9 (60)	5 (41.7)	2 (66.7)	.741
No	6 (40)	7 (58.3)	1 (33.3)	
Total	15 (100)	12 (100)	3 (100)	

The average throughput of the diploma programme was 56.1% with a range of 41.7% to 66.7%. There was insufficient evidence (p = 0.741) to reject the null hypothesis of no linear trend between cohort size and completing the course in regulation time. A combined total of 16 students from the three cohorts completed the diploma programme and graduated within the regulation time

programmes respectively, while repeaters, conversely, constituted an average of slightly less than 20% (18.8%) of first year enrolees in either programme (Table 3). This figure is broadly consistent with an earlier range of values, 8.1% to 26.9%, discovered for the dental programme at the same institution.[4] The welcome reduction in the proportion of first year repeaters between the diploma and degree programmes is encouraging.

Progress tracking

The results of this investigation showed that the average first year pass rate (83.8% vs 75.8%) for the degree programme was 8% higher than that for the diploma programme (Tables 4 and 6). This finding has not previously been described. It is difficult to explain this result, but it might be related to the student selection process.

It is encouraging to compare the first year pass rate of the oral hygiene course with that of the of dental therapy and dental courses at the same institution. It is noteworthy that the pass rate for the oral hygiene degree programme was similar (83.8% vs 83.6%) to that of the first year dental therapy programme.[5] However, they were both slightly lower than that of the corresponding dental programme (87%).[4]

The current study found that the range of the pass rate for the degree programme was 18.5% larger than that of the diploma programme (37.5% vs 19%, Tables 4 and 6). This finding indicates that the pass rate for the degree programme was highly variable (Table 6). The most interesting finding was that the first year pass rate increased as the cohort size increased (Table 6). These results do not support previous research which found an inverse relationship between class size and academic achievement for small class sizes.[18,19] The class size for the degree programme has steadily increased from a low of 8 in 2012 to a high of 25 in 2021. Further research should be done to investigate the effect of class size on pass rate.

The current study found an improvement in the pass rates from one year of study to the next (Table 4-8) These welcome findings suggest that the academic and mentoring support offered in both programmes was effective.

The results of this study showed that the dropout rate for the degree programme was more than twice (14.3% vs 6.7%) as high as that for the diploma programme. The findings of the current study differ sharply from some published studies - the dropout rate is much lower than previously reported. The Council for Higher Education (CHE) found that the dropout rate ranged between 35% and 41%.20 The Stellenbosch University working paper reported a dropout rate of 28.4%.[21]

It may well be that factors such as race, gender, matriculation score and poverty, which are widely accepted to be strongly associated with dropout in South Africa played a little role in this study.[22-24] The relative ease of transferring from one undergraduate degree programme to another compared with transferring from a diploma

Table 10: Trend in throughput for the degree programme

Completed the course in regulation time	Cohorts			Chi-Square test for trend
	2011 n (%)	2012 n (%)	2013 n (%)	
Yes	4 (50)	5 (55.6)	9 (81.8)	.138
No	4 (50)	4 (44.4)	2 (18.2)	
Total	8 (100)	9 (100)	11 (100)	

The average throughput of the degree programme was 62.5% with a range of 50% to 81.8%. The throughput increased as the cohort size increased. However, there was insufficient evidence (p = 0.138) to reject the null hypothesis of no linear trend between cohort size and completing the course in regulation time. A combined total of 18 students from the three cohorts completed the degree and graduated within the regulation time

Table 11: Combined throughputs by programme type

Programme type	Completed the course in regulation time		Total n (%)	Chi-Square test
	Yes	No		
Diploma	16 (53.3)	14 (46.7)	30 (100)	.397
Degree	18 (64.3)	10 (35.7)	28 (100)	
Total	34 (58.6)	24 (41.4)	58 (100)	
Total	18 (100)	0 (0)	18 (100)	

A combined total of 16 and 18 students from the three cohorts completed the diploma and degree programmes respectively and graduated within the regulation time. There was insufficient evidence (p = 0.397) to reject the null hypothesis that the proportions of combined students who completed the diploma and degree programmes in regulation time were equal in the population

programme to a degree programme might be a possible explanation for the discrepancy in dropout rates between the programmes. Further work is required to establish the reasons for dropping out.

Throughputs and trends

The results of this study show that the average throughput of the degree programme was 6.4% higher than that for the diploma programme (62.5% vs 56.1%). Furthermore, the range of throughputs for the degree programme was 25.1% larger than that for the diploma programme, indicating high variability. Local studies of comparable cohorts were not found - the throughput of oral hygiene courses in the five dental schools in South Africa has not previously been described.

It is encouraging to compare the throughput of the oral hygiene course with that of dental therapy and dental courses at the same institution. It compares favourably with the average throughput of the dental therapy courses and dentistry course, which has been established to be 45 percent and 40% respectively.[4,5] It seems possible that these results are due to small class sizes of the oral hygiene programme compared with the other groups of oral health science students. There are, however, other possible explanations.

The findings of the current study differ greatly from the Ministry of Education's target of 25% graduation rate for a 3-year undergraduate degree.[25] However, they are broadly consistent with other research. The Council for Higher Education (CHE) found that the throughput rates for 3-year degrees with first year of enrolment in 2010 ranged between 30% and 59%.[20]

The results of this study did not show a linear trend between cohort size and completing the course in regulation time for either programme (Tables 8 and 9). This rather disappointing finding means that the increased throughput associated with increased cohort size for the degree programme was not found to be statistically significant. The small cohort sizes found in this study may have affected the power of the Chi square test to detect a trend. It is generally accepted that the power of a test increases with increasing sample size.[26] Further studies with larger ordered categories of cohorts should be considered to test the null hypothesis.

The results of this study did not show any significant difference in combined output between the diploma and degree programmes (Table 11). This result has not previously been described. It was unexpected in view of the of the difference in the duration of the programmes. The relatively high average throughput of the degree programme is however encouraging (Table 10).

Limitations of the study

Data on age of the students was not available.

CONCLUSION

The average throughput of the degree programme was higher than that for the diploma programme. The difference was however not statistically significant.

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A Comparison of Convergence Angles of Crown preparations in an undergraduate programme at a Tertiary Institution

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ABSTRACT

Introduction

The retention of indirect dental restorations is of concern for clinicians as it influences the success of clinical outcomes. Retention and resistance are dependent on many factors including the convergence angles of the opposing axial wall tapers. Adequate axial wall taper is important in crown preparation to improve physical retention and increase resistance of the restoration.

Aims and objectives

To determine and compare the convergence angles (CA) of KaVo® teeth prepared for full coverage crown restorations by fourth year dental students in a preclinical fixed prosthodontics module in a five year dentistry training programme.

Methodology

Crown preparations produced by fourth year dental students at Sefako Makgatho Health Sciences University (SMU), South Africa, over a period of 3 years were included in this study. These preparations were digitally captured using CAD-CAM imaging technology. The images were analysed in ImageJ® software to determine the mesio-distal convergence angles. Statistical analysis was undertaken using SPSS ver. 27 for Windows.

Results

The overall mean convergence angle of 15.38° ± 6.68° was computed for n=75 crown preparations. ANOVA revealed a significant difference ($p<0.05$) in the CA among the three cohorts (2017: 16.87° ± 6.94°; 2018: 17.23° ± 6.13°; 2019: 12.02° ± 5.86°). A reasonable proportion of dental students n=25 (33%) achieved the recommended CA of 6° to 12°.

Conclusion

This study indicates that with objective evaluation tools, it is possible to improve on the intended guidelines for crown preparations during undergraduate teaching and training in pre-clinical Fixed Prosthodontics.

Keywords

Convergence angles, full coverage crown preparation; dental students, preclinical prosthodontics

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3. Prof PD Motloba: 25%

INTRODUCTION

The concept of retention and resistance form is of vital clinical concern because of the vectoring of occlusal forces that may be directed in both a lateral and/or apical directions during oral functioning.[1] Retention is the ability of a restoration to withstand removal forces along the long axis.[2] The term resistance form refers to the features of a tooth preparation that enhances the stability and durability of a restoration that affords it to resist dislodgment along an axis other than the path of placement.[3] The angle formed by the intersection of the mesial and distal axial wall tapers is routinely referred to as the convergence angle (CA) of a tooth preparation, and is the measurement of the combined taper of opposing axial walls.

The underlying tooth preparation geometry necessitates precise application of these design features through specific preparation guidelines. Retention and resistance are interrelated and inseparable design qualities that need to be integrated synergistically through meticulous tooth preparation design.[4] Retention and resistance dependent factors related to tooth preparation for full coverage restorations (FCR), include ensuring maximal cervical-occlusal height, appropriate surface texture of the preparation and most importantly, an acceptable CA.[4, 5] It is generally recognised that the smaller the convergence angle, the better the retention, and therefore, the greater longevity of the restoration.[6]

Adequate taper compensates for inaccuracies that may occur in the laboratory fabrication and processing of the restoration, as well as permitting a more favourable path of insertion.[4] However, excessive taper often results in reduced

retention,[2] cement failure[7] and pulp devitalisation.[8] Whereas, inadequate taper compromises the structural durability of the restoration, aesthetics and the patient's existing occlusion.[9] The shorter the preparation height, the more critical it becomes to limit the taper in order to increase the resistance against axial displacement. During undergraduate teaching and training of fixed prosthodontic principles, students' are taught the deleterious effects that over-preparation, under-preparation, increased axial wall inclination and reduced cervical-occlusal height can have on the health of the tooth, as well as, on the longevity of the restoration. Theoretically recommended guidelines advocate that tooth preparation walls be as close to parallel as possible, but still incorporate a slight taper, ideally, of between 4° to 6° with a recommended range of 3° - 14° regarded as acceptable. [4, 5, 10]

These guidelines were correlated with experimental studies conducted by Jørgensen[11] Kaufman[12] and Wilson and Chan[6] who showed that an inverse relationship exists between retention and taper. However, there is inconsistency in the degree of taper required for maximum retention. Theoretically, ideal taper should range from 4° to 6°, but this is difficult to achieve clinically without creating undercuts on the preparation.[4,13, 14] This translates to an ideal recommended CA of between 8º and 12º. Effective taper criteria in a clinical milieu must be defined as a realistic and measurable goal that can be visualised and is readily repeatable and achievable.[13,15]

Full coverage restorations are often recommended for the restoration of extensively damaged and endodontically treated teeth. The ability of dentists to adequately prepare and assess the preparation for optimal retention and resistance is fundamental to the success of full coverage restorations. In the undergraduate pre-clinical Fixed Prosthodontics module at School of Oral Health Sciences, Sefako Makgatho Health Sciences University, the concept of axial wall taper is taught as per the prescribed guidelines.[4] The rationale for this study was to determine; compare and evaluate the CA for teeth prepared for an anterior all-ceramic FCR by fourth year undergraduate dental students, against recommended guidelines.

MATERIALS AND METHODS

Study design

A descriptive cross-sectional study design was employed in this research.

Study population

The study population consisted of all ceramic anterior full coverage crown preparations prepared by cohorts of fourth year dental students during the 2017 to 2019 academic years. The crown preparations were included in the study, if they were prepared on maxillary central incisors 11, 21 and satisfied all the assessment requirements for crown preparation. The approval to undertake this study was granted by the SMU Ethics Committee.

These preparations were analysed using computer-aided design (CAD) technology to determine the CA for FCR prepared on maxillary central incisors 11, 21 on a KaVo® typodont housed within a KaVo® dental patient simulation unit in a simulation laboratory. Eighty seven samples were included for the study that met the pass criteria for the module.

Figure 1: Sirona inEos X5® desktop model scanner

Preparation of the KaVo® model for digital assessment

The individual tooth preparations were seated into a new maxillary KaVo® model before being digitally scanned for CA assessment. Prior to scanning, a 10mm reference line was demarcated using a pair of dividers and then plotted using a 0.6mm medium fine liner ink marker (Artline® 210), on the KaVo® model base, below tooth 11. This served to allow digital calibration by the ImageJ® computer software system, (National Institutes of health, Bethesda, MA, USA) prior to convergence angle calculation.

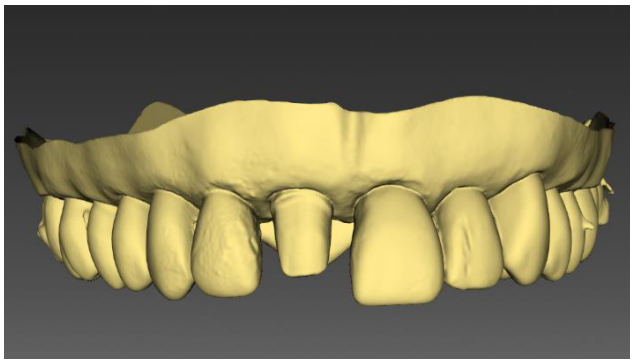
Preparation for digital scanning

All prepared surfaces of the crown preparation were surface treated with CEREC® Optispray (DentsplySirona) to enhance reflectability. This was done to allow accurate image acquisition of the digital impressions. The study utilised a Sirona inEos X5® desktop model scanner (DentsplySirona) (Figure 1) which allowed for five axis KaVo® model rotation to produce an accurate 3 dimensional (3D) rendering of the KaVo® model base and tooth preparation. The tooth preparation together with the model base were magnetically secured to the ground plate of the articulating scanning arm, which was reset before each scan, to ensure standardised image acquisition. A 3D digital scan of the tooth preparation was acquired and visually rendered on the Sirona InLab® (DentsplySirona) CAD software (v18.0) (Figure 2). Using the Sirona InLab® CAD software (DentsplySirona), the image was orientated in the standard frontal view. A screen shot of the image was then captured and imported into Microsoft® Paint application and saved as a Portable Network Graphic (PNG) file according to the allocated specimen number.

Assigning the critical point for convergence angle measurement

The saved image was imported into the ImageJ® computer software system and calibrated using the plotted reference

Figure 2: Three dimensional rendering of the KaVo® model base and tooth preparation



line. The angle calculation tool in the ImageJ® software was used to calculate the inciso-axial angle (b1° and c1°) of the mesial and distal aspects of the tooth preparation. (Figure 3). The angle calculation software used plotted tangents to the axial preparation wall (ab and dc) and a tangent to incisal reduction preparation (bc), to calculate angles b1° and c1° (Figure 3). For each sample, angles b1° and c1° were determined three times and the average value recorded for each side.

Computation of convergence angle software

Six measurements (3 mesial and 3 distal) for each sample were recorded on Microsoft® Excel® spreadsheet for analysis. To compute inter and intra-rater reliability, five specimens from each cohort, were randomly selected by an independent person and re-assessed by the primary researcher and a co-supervisor. The convergence angle x° (Figure 3) was calculated using the mathematical equation:

$$x° = -180 - [(180 - b1°) + (180 - c1°)]$$

The equation utilised the Straight Line Theorem and Sum of Angles of a Triangle to calculate the convergence angle x° of the mesial and distal axial wall preparations.

Results

Eighty seven all ceramic FCR were distributed according to these cohorts: 2017 and 2018 (n = 30) and 2019 (n = 27). Further exclusion of samples was applied to ineligible preparations that exceeded a CA of 29.5°, resulting in the following exclusion distribution (2017 = n5; 2018 = n5; 2019 = n2).

The mean mesio-distal CA for the test samples (n =75) was 15.380 ± 6.680, ranging between 4.320 and 28.830. Analysis of variance (ANOVA), revealed a significant cohort effect (based on the different years of study) on the mesio-distal convergence at the p<0.05 level for the three cohorts [F (2, 72) = 5.28, p =0.007]. Post hoc comparisons using the Tukey HSD test indicated that the mean CA score for the 2019 cohort at 12.02° ± 5.86° was significantly different from the 2017, which was 16.87° ± 6.94° and 2018 cohorts at 17.23° ± 6.13°. There was no significant difference in CA between the 2017 and 2018 cohorts. However, a significant improvement in the mean CA of the 2019 cohort was noted when compared to the 2017 and 2018 cohorts. (Table I.) Twenty-five students achieved the ideal convergence of 12° or less, of which 5 (6.6%) achieved the ideal levels of 6°. Based on the three recommendations,[3,13,14] on average more than 40% of the preparations satisfied the requisite range.[16]

Table I: Summary of CA results

Cohort	n	Minimum	Maximum	Mean	SD
2017	25	5.17°	28.16°	16.87°	±6.94°
2018	25	4.32°	27.27°	17.23°	±6.13°
2019	25	5.05°	26.54°	12.02°	±5.86°
Total	75	4.32°	28.16°	15.38°	±6.68°

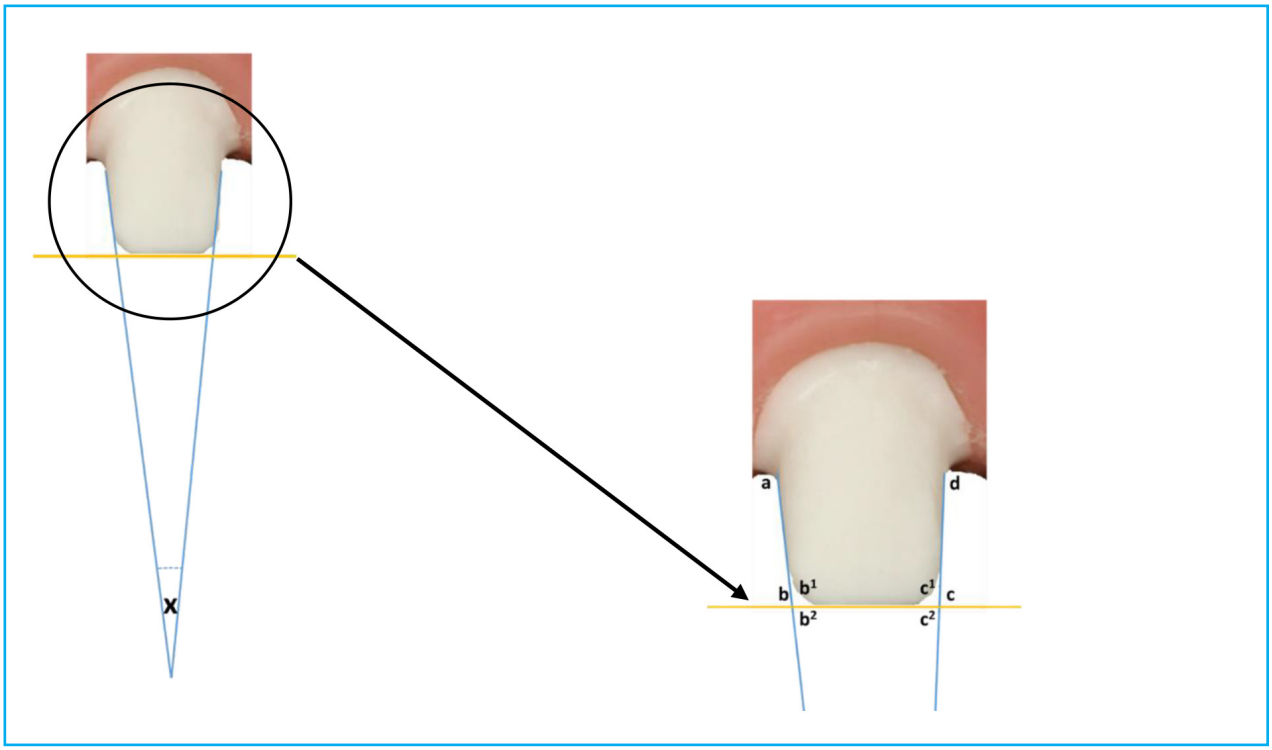
Reliability

Interclass correlation coefficient (ICC) estimates and their 95% confident intervals were calculated using SPSS statistical package version 27 (SPSS Inc, Chicago, IL), based on a single-measurement by two independent researchers, absolute-agreement, 2-way mixed-effects model. The ICC = 0.996 with 95% confidence interval = 0.981 - 0.999 is indicative of excellent reliability.[17]

DISCUSSION

The convergence angle defines the opposing axial wall taper of a crown preparation and is one of the many factors that directly affects the overall acceptability of a crown preparation.[18] Optimising axial wall taper for FCR

Figure 3: Diagrammatic representation of convergence angle x. The enlarged infographic illustrates the calculation of angle b1 and c1 which was determined using the ImageJ®



assists in achieving conservative tooth preparations' whilst simultaneously preventing undercut formation, compensating for inaccuracies in fabrication and permitting more accurate seating during cementation.[6, 19]

The results of this study yielded a mean CA of 15.38° ± 6.68° achieved by the fourth-year dental students' across three years of the study. The results also showed that 33% (n=25) of the combined cohorts achieved a CA between 6°-12°. This finding may be attributed to adherence to minimally invasive crown preparation techniques taught, as well as, the use of only parallel-sided burs in the Fixed Prosthodontics Pre-clinical module.

The literature on CA demonstrates inconsistency in the degree of taper required for maximum retention of FCR from proposed theoretical norms when compared to clinically achieved CA. Jørgensen[11] used machined brass caps to demonstrate the relationship between retention and convergence angle in cemented crowns and found that, maximal tensile retentive values were recorded at 5°, supporting theoretical recommendations. Kaufman *et al*[12] examined the effects that varying convergence angles (1°, 5°, 10° 15°, 20°) would have on the retention of full coverage crowns. Their results have experimentally demonstrated that retention increases as the convergence angle decreases. Wilson and Chan[6] recommended total occlusal convergence angles of between 10° - 20°. They based this on the fact that, these angles are achievable in a pre-clinical setting and during clinical tooth reduction. These CA should provide adequate resistance against dislodgement of restorations when coupled with other tooth preparation guidelines.[6]

A theoretical and clinical investigation of taper by Mack[14] showed in laboratory observations that a minimum taper of 5° would need to be achieved to ensure the absence of undercuts during preparation, which supported proposed theoretical CA recommendations. However, on clinical investigation a mean CA of 22° was achieved, showing no correlation to theoretical recommendations. He concluded that both the theory and practice recommended tapers of 5° are difficult to achieve clinically.[14]

The lack of operator experience is often cited as common reason used to explain why undergraduate dental students over-taper teeth preparations.[20,21] Annerstedt *et al.*[20] assessed CA values of full crown preparations done on anterior, premolars and molar teeth produced by both dental students and general practitioners. However, their investigation found an average CA value of 21° across all preparations types by both dental students and practitioners with no correlation to experience between the two groups.[20] Their study was corroborated by a later study conducted by Patel *et al*,[21] which established only a 1° difference between the mean mesio-distal CA of final year dental students when compared to general dental practitioners. Similar earlier clinical studies by done by Leempoel *et al*[22] and Nordlander *et al*[23] which assessed the CA produced by dentists with differing levels of experience, as well as, training and qualified prosthodontists. These two studies reported a mean CA for tooth preparations that ranged from 12.2° to 20.1° with no apparent correlation to the clinicians' level of education and/or their experience.[22 23]
Nordlander *et al*[23] study further showed that ideal preparation taper is seldom clinically achieved. A review article by Goodacre *et al*[24] that set to identify scientific guidelines for tooth preparations concluded that teeth should exhibit a convergence angle between 10°-20°.

Currently a significant variation exists within the literature on the methods employed to calculate convergence angles due to the lack of a standardised research model.[25] Studies assessing CA used a variety of methods to measure axial wall taper and CA. These methods include calibrated photography with projection of dies[22, 26] projected silhouette tracings,[21,23,27] microscopic photography,[18] 3D laser scanning[28] and 3D CAD optical imaging.[13]

In this study, 3D CAD image acquisition was utilised for its high degree of trueness and precision in dimensional replication of the individual tooth preparations.[29] A recent study by Emir and Ayyildiz[29] evaluated the trueness and precision of the Sirona inEos X5® and found a trueness accuracy of 26.1µm±2.63µm and precision accuracy of 26.1µm±1.94µm. This shows that the scanner has high accuracy in dimensional replication of the scanned object. Following image acquisition, an angle analysis from the standardised labial view of each preparation using the ImageJ® software was done for each specimen. This analysis software was utilised due to its accessibility, reliability, ease of use and its potential as a valuable educational tool. This was validated by an inter and intra reliability confidence interval of = 0.981 - 0.999.

An additional finding in the study was the reduction of the mean CA (12.02°) in the 2019 cohort, compared to the previous cohorts. A plausible inference for this improvement may be the introduction of magnified intra-oral crown preparation demonstrations. This was conducted using a dental microscope. This differed from the 2017 and 2018 cohorts, as previous demonstrations were recorded on a video recorder without such a high degree of magnification as offered by the use of a microscope. Recordings of the preparation procedure were accessible to students via the blended learning platform Blackboard®. This finding is supported by an investigation conducted by Robinson and Lee[30] into the use of magnification in pre-clinical teaching of crown preparations for undergraduate students. Their study showed that undergraduates produced more accurately tapered preparations using microscope video magnification as a demonstration and teaching aid, compared to students taught via conventional methods i.e. without magnification. They concluded that the use of magnification improved the undergraduates' understanding of taper preparation by enhancing their ability to visualise and evaluate this critical measurement during the teaching process.[30]

CONCLUSION

Objective assessment of convergence angles produced by the cohorts of 3 different years of undergraduate students demonstrated that the majority of the students were able to produce CA within recommended guidelines. A significant difference in reduction of CA was found in the 2019 cohort of students when compared to the two previous cohorts. This may be attributed to enhanced teaching and training aids. However, further investigation is required to more definitively support this assertion. With the development of more accurate technological tools to enhance the teaching of dental procedures, it is envisioned that dental schools will adopt such technologies in order to enhance and aid the

teaching, training and learning of dental procedures, which would serve to improve on the quality of dental care that is administered by future dental practitioners.

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Disclosure

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Association of parental factors and delayed dental care for children

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ABSTRACT

Introduction
There is a general perception that majority of parents delay seeking oral health care services for their children. However, the reasons for this health seeking behaviour and the related contributing factors are poorly understood.

Aims
To investigate the parental factors that influence delayed dental care for their children.

Methodology
A descriptive cross-sectional survey that was conducted at MEDUNSA Oral Health Centre and other oral health facilities within Tshwane oral health district. Parents of children 12 year and younger participated in the study.

Results
The average age of 350 parents and children in the study was 36.94 (±9.40) and 6.31 (±2.38) years respectively. Most parents were female 315 (90.0%), unemployed 281 (80.3%) and reached high school education 281 (80.3%). The association between gender, age, employment and dmft with delayed dental treatment for children was not statistically significant. Parents considered acute medical conditions as urgent compared to dental pain and conditions (OR =1.27). Regular use of home remedies and medications exacerbated delayed dental visits for children, irrespective of the problem.

Conclusion
Parental attitude and perception of oral health contribute delayed dental visits by children. Majority of parents resorted to alternative remedies such as self-medication in managing children`s oral health pain and conditions instead of seeking oral health care for their children.

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BACKGROUND
Dental caries is the most prevalent condition among children[1], affecting 620 million (9%) children globally.[2] In South Africa, as many as 60% of children have dental caries of which 80% remain untreated indicating that South Africa has not achieved the National Department of Health goal to have at least 50% of children under the age of 6 years being caries free.[3] A large population of children are still experiencing a huge burden of untreated caries, which results in serious complications. The cost of delayed treatment of dental disease is exorbitant.[4] The impact of dental caries includes , school absenteeism, learning difficulties among children and loss of income for parents due to work absenteeism.[4] The lost productivity time is estimated to equal 52 million hours of work.[5]

Children are not responsible for their own health nor the identification of their health needs and care. It is the responsibility of parents or guardians to ensure that the rights of children to health care is realised. Therefore, delays in seeking dental care for any child is the failure of the parents or guardian to discharge their parental duties and responsibilities. Several individual and societal factors contribute to health seeking behaviour, utilisation of services or failure to access the needed services. Poor education, unemployment, young age, families with large number of children, and other systemic socio-economic barriers are factors associated with neglect and delays in dental visits for children.[6,7] Parental oral health status, knowledge and perceptions are correlated to attitudes and behaviour towards health and oral health.[8] There is a general misconception that dental conditions affecting children are not important and that dental extractions resolve majority of dental problems in children.[9] Evidence suggests that children from lower income families have a higher prevalence of caries and of untreated oral disease and a lower tendency to visit the dentist. Children living under these socio-economic environments are prone to dental neglect owing to high barriers to access healthcare service.

The current study sought to explore the parental factors associated with delayed dental visits by children, which in the context of this study is viewed as inappropriate health seeking behaviour (HSB).

Conceptual framework for the study

Variety of behavioural models have been adapted to explain patterns of health care utilisation or health seeking behaviour.[10-13] According to these models, several factors are critical in predicting the likelihood of action or inaction by individuals in responding to health episodes. Personal and societal resources, culture and beliefs are amongst the most critical factors in healthcare seeking behaviour.[12,14] The Andersen and Newman healthcare utilisation model was adapted as the framework for this study.[15] This model is appropriate in explaining critical factors implicated in delayed dental visits by children (healthcare utilisation). The model consists of three factors. First, the predisposing factors which are the social and cultural factors that precede illness. For example, demographics (age, gender, education, occupation), culture, health beliefs, attitude, and knowledge.[16] Second factor, includes enabling logistical factors such as means to access health services (travel costs, insurance etc.).[15] Third, is the needs factor, comprised of an individual's perception of the health condition (severity and associated symptoms).[17] In terms of this study, the needs factors focused on the parental perception of the child's dental conditions, severity and pain.

MATERIALS AND METHODS

Study design and study setting

A cross sectional survey was conducted at the Medunsa Oral Health Centre (MOHC), a specialized public tertiary oral health facility. Additional facilities included in this study are referral clinics and a hospital in the MOHC catchment area. (Pretoria North clinic, Boikhutsong clinic, KT Motubatse clinic, Soshanguve clinic 2, Kgabo clinic and Odi Hospital dental clinic). Patients managed at MOHC pay user fees based on income levels, while all other clinics have no user fees. All the facilities were included in the study.

Sample size

The sample size was estimated to be 350 parents and child pairs, based on the following reliable assumptions: (i) 30% of parents delay children's dental visits[18]; (ii) margin of error set at 5%, and precision of 5%. Using the PASS (Power Analysis and Sample Size) version 21.0.2, three hundred and eighteen (318) parent-child pairs were needed to achieve the desired estimated precision with 90% power. The final sample size of 350 was considered to counteract non-response and missing data. The general equation for this sample size calculation is $n = (Z^2PQ /D^2)$[19]

Study population and sampling

The study population comprised of guardians or parents who brought their children aged 12 years or younger for dental consultation. Parents of children older than 12 years were excluded. The children reported to the clinics due to referrals from school or clinic or brought by parents due to pain or other dental problems. Proportional samples were recruited for each clinic based of the weighted clinic size, therefore large clinics recruited proportionally more patients than smaller ones. The enrollment process continued until the required sample was reached for each clinic. For consistency, the term parents is used instead of guardians throughout the article.

Data collection

The questionnaire used in this study was adapted from previous studies assessing caregivers' factors associated with late dental visits by children.[6-8] The tool was translated into Setswana and piloted for content and face validity. The researcher and supervisors evaluated all the questions for relevance, simplicity and clarity. An expert Setswana speaker translated the validated English questionnaire into Setswana. Once completed, the tool was back translated into English by a different language expert. Inconsistencies were resolved between the translators and the researchers. The questionnaires comprised three sections:

(i) Demographic characteristics of parents and children, which measured age, gender and socioeconomic status (education and employment status)
(ii) Sixteen questions assessed parental knowledge, attitudes, and perceptions about child's oral health
(iii) Children's oral health status assessed as part of comprehensive examination on a dental chair. Calibrated clinicians recorded the dmft and other dental conditions based on the WHO guidelines

Measurement of delayed dental care for children

Delayed dental visit is not well conceptualised, its measurement is at best obscure or unclear. Normatively, any patient who reports for dental care with signs and symptoms has delayed seeking care. However, we wanted to develop a measure that would incorporate existing barriers to care, and the effort to seek care. Delayed dental visit, as a dichotomous variable represented the probability that a child would receive dental treatment after the outcomes of interest had occurred, beyond the specified period. Arbitrary time was set by researcher for treatment of dental pain to be seven days (week) or more. For general dental problems, the duration was set at 1 month or more. Therefore, dental consultation for children beyond the specified times (1 week or after a month), was regarded as delayed dental treatment for dental pain and general dental problems respectively. These variables were computed based on several questions assessed in the study: (i) why did you bring your child to the dental clinic, and (ii) how long have you been aware of the child's problem.

Data analysis

Data were analysed using SPSS version 23 software. Descriptive statistics included frequencies, measures of central tendency and dispersion. The magnitude of association (odds ratios) were computed for the dependent variable or outcome (delayed dental treatment compared to early treatment) and independent variables: (i) knowledge, attitude and perception of guardians about child's oral health; (ii) demographic variables, and (iii) clinical variable (dmft). The significance level for the statistical analysis was set at 5%.

Ethical Considerations

Ethical clearance to conduct this study was granted by Sefako Makgatho Health Sciences University Research and Ethics Committee (SMUREC/D/221/2016: PG). The districts and hospital managers in the participating facilities also granted permission. Participants consented to take part in the study and anonymity was ensured throughout the research.

RESULTS

Demographic profile of parents and children

Of the 350 parent and child pairs in the study, 214 (61.1%) of children were below 6 years with the mean age of

6.31 ±2.38 years and largely female, 223(63.71%). Most parents 244(72.6%) were aged between 25-44 years, mean age 36.94 ±9.40, the majority were female 325(90.0%) unemployed 281(80.3%) and reached high school 281(80.3).

Table 1. The characteristics of the participating guardians (n=350) and children (n=350)

	Variable	n (%)
Gender (Child)	Male	127 (36.3)
	Female	223 (63.7)
Gender (Parent)	Male	35(10.0)
	Female	315 (90.0)
Age (Child)	1-6	214 (61.1)
	7-12	136 (38.9)
Age (Parent)	≤ 24	22 (6.3)
	25 – 34	139 (39.7)
	35 – 44	115 (32.9)
	45 -55	58 (16.6)
	≥ 55	16 (4.5)
Education	No formal education	9 (2.6)
	Up to high school	272(77.7)
Employment status	Diploma/Degree	69(19.7)
	Employed	69(19.7)
	Unemployed	281(80.3)

Parental knowledge, attitudes, and perceptions of oral health

Parents' knowledge, attitudes, and perceptions about children's oral health is confirmed in Table 2. Over half of the parents (52.9%) indicated that pain was the main reason for bringing their children for dental consultation. Two-thirds of the parents perceived their children's oral health as fair (66.3%), and 87.7% recognized bad diet as the cause of dental problems. As many as 52, 6% of the parents "did nothing" to manage child's dental pain, while 41.1% "did nothing" to manage a presenting dental condition. In effect, 88% of parents were inclined to seek immediate healthcare for medical conditions (figure 1) and (62.3% preferred dental extractions as a means of dealing with dental problems. (Table 2).

Association of parental factors with delayed dental visits for children

Table 3 and 4 show the association between paternal factors and dependent variable (delayed dental visits by children). Differences in education and employment among the parents with respect to time of dental consultation

Figure 1. Conditions for which parents are inclined to professional help for their children

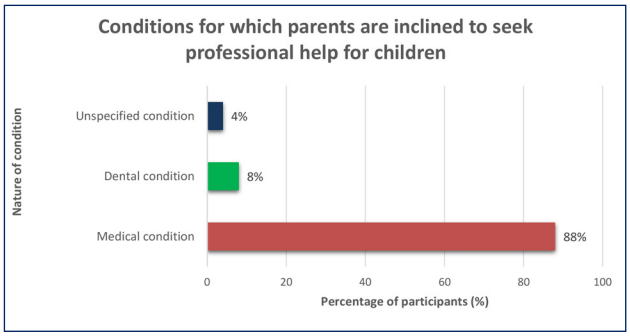

Table 2. Parent's knowledge, perception and attitude about oral health (n=350)

Variable	n (%)
Reason for child's dental consultation	
Dental caries	46 (13.1)
Pain	185 (52.9)
Checkup or referral	119 (34.0)
Perception of child's oral health status	
Excellent	54 (15.4)
Fair	232 (66.3)
Poor	64 (18.3)
Causes of oral poor oral conditions	
Bad diet	307 (87.7)
Other causes except diet	8 (2.3)
I don't know	35 (10)
Management of child's dental pain	
Home remedies	83 (23.7)
Medication	83 (23.7)
Nothing	184 (52.6)
Management of child dental conditions	
Consult (dentist or traditional healer	92 (26.3)
Home care (remedies)	114 (32.6)
Nothing	144 (41.1)
Importance of milk teeth	
Aesthetics or function	210 (60.0)
Aesthetics and function	96 (27.4)
Not Important	44 (12.6)
What is the fate of affected milk teeth	
Extraction	218 (62.3)
Save	67 (19.1)
Don't know	65 (18.6)
When do you abandon home care to consult	
When pain persists	131 (37.4)
When the problem does not resolve	35 (10.0)
Not answered	184 (52.6)

for pain and other dental conditions were statistically insignificant. However, parents with tertiary education were 1.82 times more likely to delay dental visits for their children for other dental problems (p=0.03). Similarly, parental mean ages were not statistically significant for visitation times; p-values were 0.89 and 0.49, for those with pain and other dental conditions respectively. For children who consulted with dental pain, the severity of caries (dmft) did not differ significantly between those whose dental visits were delayed and those whose dental consultation was on time, $F(1,348) = 0.20$, $p = 0.66$. In the same way, no differences in dmft scores were reported for children who consulted for dental conditions, $F(1,348) = 2.00$, $p = 0.16$. The caries experience among the parents did not have any impact on the timing of dental visits for children.

There was a 93% and 81% reduction in delayed dental visit when a child was in pain or had caries, compared to 69% and 39% when a child had other dental conditions. Therefore, dental pain and dental caries compared to other dental conditions are significant reasons why parents seek dental treatment for their children without delay. Parents who perceived their children's oral health as excellent or fair were more likely to delay dental treatment. Thus, perception influenced the probability of dental delay, though the findings are statistically insignificant. For those parents who used home remedies and medication

Table 3. Association of Parent's knowledge and attitude about oral health and delayed dental visit due to pain

Delayed visit vs not delayed	
Variable	**OR (95% CI)**
Gender of the parent	
Male	0.92 (0.46: 1.84)
Female	1
Education level of parent	
Tertiary education	0.81 (0.48: 1.38)
Up to high school	1
Employment status of parent	
Employed	0.94 (0.55: 1.59)
Unemployed	1
Reason for child's dental consultation	
Pain	0.07 (0.03: 0.16) *
Dental caries	0.19 (0.07: 0.56) *
Checkup or referral	1.00
Perception of child's oral health status	
Excellent	1.14 (0.53: 2.47)
Fair	1.53 (0.85: 2.78)
Poor	1.00
Management of child's dental pain	
Nothing	1.00
Home remedies + medication	4.06 (2.45: 6.74) *
Knowing the Importance of milk teeth	
Aesthetics and or function	0.96 (0.47: 1.95)
Not Important	1.00
What is the fate of affected milk teeth	
Don't know	1.00
Extraction	1.23 (0.66: 2.29)
Save	0.81 (0.37: 1.81)
Which conditions require urgent medical attention	
Acute medical conditions	1.27 (0.52: 3.11)
General medical conditions	0.85 (0.35: 2.05)
Dental condition	1.00
When do you abandon home care to consult	
Not applicable	1.00
When pain persists	0.22 (0.13: 0.37) *
When the problem does not resolve	0.39 (0.17: 0.89) *
*statistically significance	

Table 4. Association of Parent's knowledge and attitude about oral health and delayed dental visit due to other dental conditions

Delayed visit vs not delayed	
Variable	**OR (95% CI)**
Gender of the parent	
Male	0.74 (0.34: 1.65)
Female	1
Education level of parent	
Tertiary education	1.82 (1.06: 3.14)*
Up to high school	1
Employment status of parent	
Employed	1.04 (0.59: 1.84)
Unemployed	1
Reason for child's dental consultation	
Pain	0.21 (0.13: 0.34) *
Dental caries	0.61 (0.30: 1.21) *
Checkup or referral	1.00
Perception of child's oral health status	
Excellent	0.92 (0.44: 1.90)
Fair	0.84 (0.48: 1.45)
Poor	1.00
Management of child's dental pain	
Nothing	1.00
Home remedies + medication	3.66 (2.34: 5.71)*
Knowing the Importance of milk teeth	
Aesthetics and or function	0.89 (0.47: 1.67)
Not Important	1.00
What is the fate of affected milk teeth	
Don't know	1
Extraction	2.04 (1.16: 3.58)*
Save	1.63 (0.82: 3.25)
Which conditions require urgent medical attention	
Acute medical conditions	1.19 (0.53: 2.68)
General medical conditions	1.02 (0.45: 2.30)
Dental condition	1.00
When do you abandon home care to consult	
Not applicable	1.00
When pain persists	0.29 (0.13: 0.37)*
When the problem does not resolve	0.23 (0.10: 0.53)*
*statistically significance	

to manage dental pain and other dental conditions, the probability of the delayed dental visit for children is expected to increase four-fold. The odds ratios were, 4.06 (2.45: 6.74) and 3.66 (2.34: 5.71) respectively. Thus, regular use of home remedies and medication exacerbate delayed dental visits for children, irrespective of the problem. Having knowledge about the importance of milk teeth reduced probability of delayed dental visits for pain and other dental conditions. Similarly, for those parents who believed that milk teeth should be saved, there was a 19% reduction in delayed visits compared to those who did not. On the contrary, the belief that the fate of milk teeth was dental extractions increased the probability of delayed dental visits, ORs = 1.23 and 2.04 for pain and other dental conditions respectively. The probability of delayed dental visits increased by 27% and 19% respectively, for parents who considered acute medical conditions (fever, diarrhoea) as requiring urgent attention than dental conditions (pain and other problems). However, general medical conditions in children did not take precedence over dental conditions, especially dental pain, OR 0.85 (0.35: 2.05). Persistent pain and un-resolving dental problems were associated with significant reduced dental visit delays, odds ratios range between 0.22 and 0.39.

DISCUSSION

The discussion is based on the three key components of the Anderson and Newman framework namely, the predisposing, enabling and need factors. Critical

predisposing factors to delayed treatment for children by parents include gender, education and employment status. This study showed that parental gender, level of education and unemployment have no significant impact on dental visits for children. These results differ from published literature, which suggests that females are more likely to seek care for all members of the family.[20] Similarly, literature shows that parental educational level significantly influenced the utilization of services and children's dental visits.[21] Parents with low educational achievements were likely to delay or miss their children's dental visits.[22] Therefore, low family income and high costs of dental care could be contributing to this delay, as well as failure to attend dental appointments.[23] This study could not corroborate the critical role of socio-economic status on delayed dental visits by children. The study findings failed to demonstrate that parents with better socio-economic fortunes, that is education and employment, could access dental care for their children timeously. For these parents their socioeconomic standing was relatively inconsequential in ushering meaningful advantage or opportunity to reduce delayed dental visits for their children.

We hypothesise from definition that, delayed dental visits, are indicative of unplanned, random, episodic and reactive engagement with the oral health services. Delayed dental visits for children, suggests that parents may lack the resources and opportunity to access even free public oral health services regularly and consistently. We contend that in poor communities, this phenomenon is prevalent; most parents tend to attend to physiological needs, like food and shelter ahead of health and safety. Additionally, limited financial resources and time are directed towards more critical areas than dental services, resulting in delayed dental care.

The failure to demonstrate the association of SES and delayed dental visits is attributable to the study design and measurement. Cross-sectional studies cannot demonstrate the changes in services utilization (delays) over time and across different strata. There we were unable to show the long-term effects employment status and education dental visitations. We used employment and education as proxies for socioeconomic status instead of health index (HI). This index is difficult to compute and ascertain in our settings as it combines data on durable assets, housing characteristics and access to services. These limitations might account for the lack of empirical significant association between SES and outcomes of interest.

According to Andersen[13], utilizations of oral health services is also influenced by the perceptions of one's oral conditions. In this case, parental perceptions and attitude towards their children's oral health will affect the utilization of oral health services. Dental pain and caries experience in children prompted parents to bring children for dental consultation, without delay. There was a 93% and 81% reduction in delayed visitations for children respectively due to these conditions. However, most parents still opted for self-medication (OR = 4.06) and only abandoned home care when the pain persisted (OR =0.22) or condition did not resolve (OR = 0.39). Compared to similar studies, parents sought dental treatment when the children's needs were severe and once affordable options have been explored.[20] This oral health seeking behaviour underpins the role of enabling factors such income and education in dental visitations. Income is a significant enabling factor and barrier to access dental care.[24] The poor face exorbitant travel and dental service costs in spite of their catastrophic state of living.[20,25] Unsurprisingly, parents considered acute medical conditions as urgent compared to dental pain and conditions (OR =1.27). Dental care is not prioritised in poor settings; it is often perceived as additional or optional treatment except for dental extractions, which are deemed necessary and ultimate .[26]

Timeous dental visits for children are crucial in ensuring that possible clinical and socio-economic consequences of untreated dental conditions are minimised or completely averted. Untreated oral disease such as caries, worsens with time and eventually requires more serious and expensive treatment to resolve. Early contact with dental professionals affords children the opportunity to access dental care, reduce dental phobia, improve compliance and leads to good oral health outcomes.[27,28] Parental factors such as poverty, unemployment, education and abject inequality remain serious barriers for poor children to access dental services.[28,29] Delays in the utilization of regular preventative, promotive and curative services among the poor will worsen oral health outcomes.

CONCLUSION

The results of our study show that the parental attitude and perception; dental pain and caries in children reduce delayed dental visits. The use of home remedies and self-mediation contribute to delayed dental visits. similarly, unemployment, poor education and female gender may exacerbate delayed dental consultations for children.

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The impact of covid-19 lockdown on maxillofacial related services at tertiary dental institution

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ABSTRACT

Background
In the wake of the devastating COVID-19 pandemic, many countries in the world instituted various protocols to limit the spread of the disease and to reduce the burden on health care facilities. However, the unintended consequences of these restrictions included the reduction of human mobility, limited access to health care services, resulting in delayed or missed medical treatment.

Aims
The aim of the study was to assess the impact of the COVID-19 lockdown restriction on maxillofacial services.

Methodology
This retrospective and descriptive study of patient's clinical records, spanned from October 2019 to August 2020.This period included the pre-lockdown (October –December 2019) and the different lockdown (levels 5,4, and 3) periods. Complete clinical patient records were included for analysis.

Results
The study revealed a 88%, 86%, and 45% decline in maxillofacial and oral surgery consultations during levels 5, 4 and 3 respectively. Third molar impaction related complaints such as pericoronitis, pain and sepsis were the predominant consultation motives during all levels of lockdown periods. Gender and age of patients had no impact on the consultation rates during the course of the study.

Conclusion
The Covid-19 pandemic related lockdown restrictions affected the service provision for maxillofacial patients seen at this institution.

Key Words
Covid-19, SARS-CoV-2, pandemic, maxillofacial services,

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INTRODUCTION
The COVID-19 pandemic-induced mortality and morbidity affected several millions globally since the outbreak of the disease in Wuhan China in December 2019.[1] Despite many localized interventions, the global effort has been lackluster and the pandemic continued to wreak havoc especially in under-resourced settings. Tracking and tracing of the infected and affected persons were among the early-stage activities to mitigate the spread of COVID-19.[2] Travel restrictions were imposed locally and internationally[3] together with non-pharmaceutical interventions.[4] To date, social distancing, wearing of masks, and handwashing remains the most cost-effective interventions against COVID-19.[5] These interventions are aimed at slowing down the spread of the SARS-CoV-2 virus, flattening of the infection curve and therefore limiting the pandemic severity and duration.[6] The rationale for restricting personal freedom of movement was found in an attempt to protect the capacity and integrity of the health systems infrastructure and resources.

The South African lockdown has 5 alert levels, from the highly restrictive level 5 (hard or total) lockdown to level 1 characterised by the return to some form of normality with limited precautions.[7] Despite the legislation that permits continuation of essential health services, the pandemic resulted in an unintended decrease in service offerings and a decrease in patient-access to health care services and facilities. The treatment of urgent and emergency services took precedence as the restriction tightened and the pandemic worsened. It was observed that during periods of restrictions, such as pandemics or national

disaster, healthcare utilization decreases. Elective and preventative services were postponed or delayed, and often patients reported reduced healthcare visits due to fears of contracting the virus in health facilities.[8]

The impact of Covid-19 on the health system varied markedly depending on the type of healthcare facility, nature of services provided, location and size.[9] The utilization of health services involves a complex interaction between means to access health services (economic and social) and perceptions of the severity of one's condition, and availability of staff and other needs.[10] The lockdown restrictions influenced utilization of services, depending on the availability of means (transport and finances) and location of the health care facilities.

Globally, dental services were limited to emergency treatment; however, urgent maxillofacial services such as, pain relief, trauma, infection and pathology continued to be provided.[11] Similarly, facilities providing emergency medical/dental care and urgent maxillofacial services remained operational during lockdown.

We hypothesised that the successive levels of COVID-19 related lockdown restrictions had an impact on maxillofacial and oral surgery services.

AIM OF THE STUDY

The aim of the study was to assess the impact of the lockdown restrictions on maxillofacial service provision. To achieve this, two related questions were examined:

(i) would the volume of consultations for maxillofacial and oral surgery services be affected by the Covid-19 pandemic lockdown restrictions? We hypothesized that the outbreak resulted in meaningful reductions in the volume of patients seeking consultation.

(ii) did changes in healthcare services utilization due to the SARS-CoV-2 outbreak differ by gender, age, and time? We hypothesized that these variables influenced patient behaviour regarding the utilization of services.

METHODOLOGY

Study design

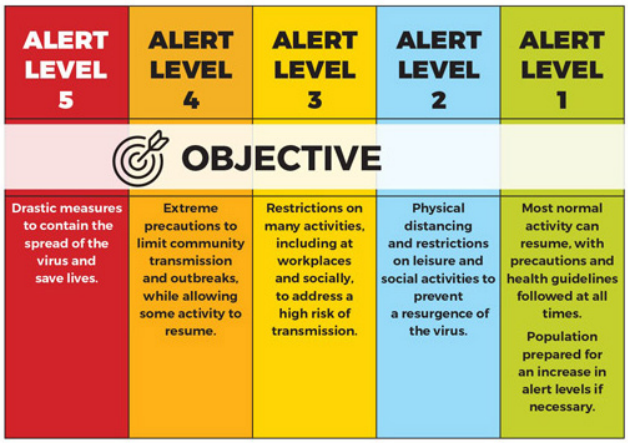
This was a retrospective, records-based descriptive cross-sectional study.

Time and setting of the study

The period of the study was from October 2019 to August 2020. It included the sequential phases: normal pre-COVID-19 pandemic, and the subsequent different levels of the lockdown periods during the COVID-19 pandemic. The research was based on the audit of complete clinical records of patients that presented to the Department of Maxillofacial and Oral Surgery (MFOS) during the study period. Lockdown periods were categorised as follows (Figure 1):

1. State of Normality - From 1 October to 31 December 2019. This period of quiescence reflected a state of normalcy, and for this study was be used as a reference point for all the changes in service delivery.
2. Pre-lockdown – from 1 January to 31 March 2020, as the world was already sensitised to the impeding pandemic.

Figure 1: South Africa –lockdown alert levels.



3. Level 5 Lockdown: from the 1st to 30 April 2020, hard lockdown.
4. Level 4 lockdown: from the 1st to 31 May 2020, modified hard lockdown.
5. Level 3 Lockdown: from 1 June to August 2020, eased lockdown.

Data sources and outcomes

We extracted all available data from the health services utilization information system. The records included clinical and demographic data from patients who consulted MFOS section. The accuracy and completeness of the electronic data was validated by comparing representative sample of these records to the physical clinical records. Incomplete clinical records were excluded from the research.

Ethical approval or the study

The research received ethical approval from the Sefako Makgatho Health Sciences University Research Ethics committee (SMUREC/D/25/2021: PG).

Statistical analysis

SPSS version 25 was used for all analyses, and the level of significance was set at α=0.05. Chi-square tests, Analysis of variance (ANOVA) and Kruskal-Wallis tests evaluated association of variables over different levels of the lockdown.

Figure 2: Consultation by treatment type and time

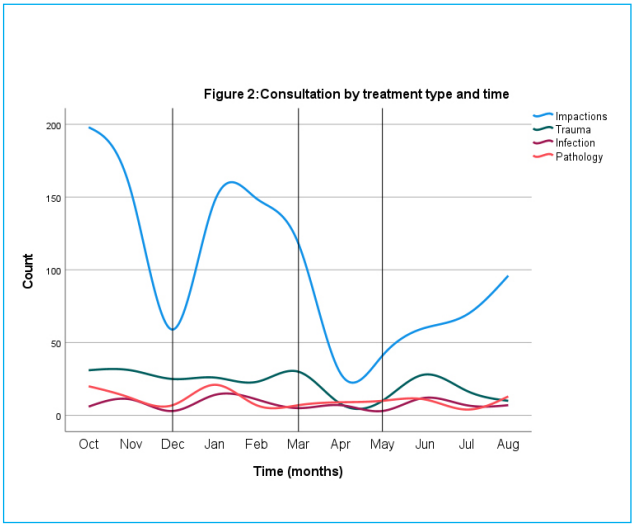


Table 1. Patient characteristics and type of treatment during lockdown periods

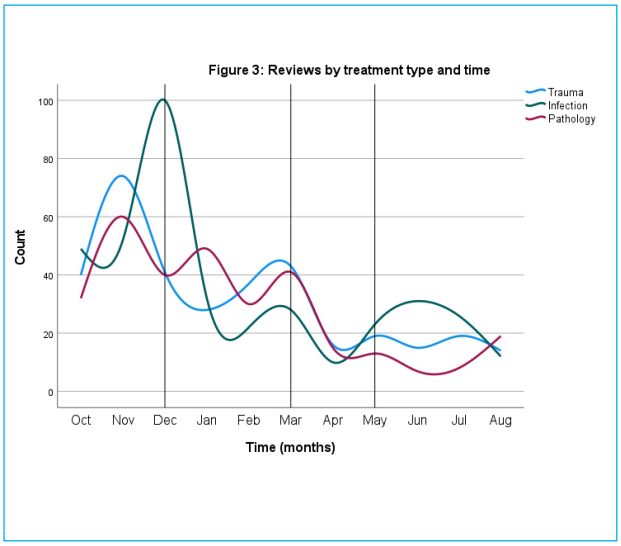
	PERIOD					
Variable	**Pre Lockdown**	**Level 5**	**Level 4**	**Level 3**	**Test**	**p-value**
Visits n (%)	899 (55.6)	105 (6.5)	120(7.4)	494(30.5)		
Gender						
Male	477(53.7)	61(58.1)	72(60.0)	251(50.8)	X^2	1
Female	422(46.9)	44(41.9)	48(40.0)	243(49.2)		0.223
Age						
Mean(SD)	32.66(13.73)	33.96(17.99)	34.16(16.66)	33.51(18.43)	ANOVA	0.540
Median(IQR)	30.0(24.0,38.0)	32(23.0,45.0)	30.0(24.0,41.75)	31(24.0,39.0)	K-W	0.669
Consultations					X^2	
Impactions	414(58.4)	29(4.1)	41(5.8)	225(31.7)		0.000
Infection	30(45.5)	7(10.6)	3(4.5)	26(39.4)		0.133
Pathology	35(42.7)	9(11.0)	10(12.2)	28(34.1)		0.40
Trauma	79(52.0)	8(5.3)	10(6.6)	55(36.2)		0.442
Reviews					X^2	
Infection	82(44.6)	10(5.4)	23(12.5)	69(37.5)		0.001
Pathology	120(65.9)	15(8.2)	13(7.1)	34(18.7)		0.002
Trauma	108(56.5)	16(8.4)	19(9.9)	48(25.1)		0.160

RESULTS

The study shows that 1618 patients sought maxillofacial care from 01 January 2020 until 30 August 2020. The utilization of these oral health services declined drastically during the lockdown. The number of patients receiving services at MFOS-SMU was 899 in the pre-lockdown period, 105, 120 and 494 in the lockdown level 5, 4 and 3 periods respectively.

This translates to 88%, 86% and 45% decline in patient numbers compared to the pre-lockdown levels. Slightly more males than females consulted the institution during all levels of lockdown (p=0.22). The patient-age mean of 33.1, and median 30.0 years, showed no significant differences (p=0.54 and p=0.67) respectively across the different levels of lockdown 2020.

Figure 3: Reviews by treatment type and time



The number of patients who consulted due to impacted third molar (3Ms) problems was higher than all other types of consults during all levels lockdown. Compared to global pre-covid period (October to December 2019), the number of consultations showed a substantial decline. (Figure 2). Consultations for infection, trauma and pathology were more frequent during pre-lockdown and level 3 lockdown. However, these differences were not significant (Table 1). The number of patients reviewed for trauma, pathology or infections were higher than cases of consultations for all levels of the lockdown. Reviewed cases were significantly lower during lockdown levels 5 and 4, for infection and pathology (p=0.001 and 0.002). Figure 3 shows the marked decline in the number of review cases from October 2019 until the end of May 2021.

Overall, the period of hard lockdown (levels 5 and 4) resulted in a drastic drop in the number of patients reporting at the facility for maxillofacial treatment.

DISCUSSION

This retrospective study sought to evaluate the impact of the COVID-19 pandemic lockdown restrictions on the utilization of maxillofacial services in a tertiary referral hospital. The study focussed on comparing the volume (quantity) of consultations and the type of clinical findings (quality) reported at the department during the studied periods. This study provides evidence that the pandemic has affected all dental services including urgent and emergency care. The reduction in the number of patients attending maxillofacial services in our setting is immense compared to similar institutions. Our findings show a decline of 88% and 86% during level 5 and 4 lockdown periods. In comparison Bartella[12], Donohoe[13] and Vishwakarma[14] reported a 45%, 46% and 73.90% drop in maxillofacial patients due to COVID-19. We reported similar differences for trauma 9.3% versus 35%.[13]; and

consultations for infection 4.08% compared to 28%.[13] More reviews were recorded than consultations for cases of trauma, infections, and pathology for all periods of the lockdown. Globally, comparatively more cases of maxillofacial trauma, infection and pathology were treated than in our clinic.[15,16]

Most hospitals in the developing world adopted COVID-19 prevention protocols more readily and were thus able to resume maxillofacial operation on a regular basis. The few consultations at this tertiary hospital are indicative of the low number of patients referred from feeder clinics and hospitals. The majority of these institutions reduced their operating times or suspended services altogether during the lockdowns. The change in services times might account for the reduction in referrals for oral pathologies. Patients in the resource constrained environment often face financial, logistical and transport challenges that often derail their access to maxillofacial treatment. The situation worsened during the lockdown as resources were redirected towards the pandemic control. The majority of patients seen in our facility are indigent and rely on state-funded transportation for their hospital access.

Treatment of impacted third molars were performed more frequently during all phases of the lockdown than other services. Impacted third molars are associated with severe pain, pericoronitis, swelling, trismus and other signs of spreading infection.[17] Therefore, patients suffering from these dental complications are likely to seek help than patients with innocuous soft tissue pathology. Several studies confirm that during the pandemic dental extractions were performed most frequently.[18]

We attribute the decline in the utilization of maxillofacial services in our facility to several reasons: Firstly, the hard lockdown severely restricted the movement of people including visits to healthcare facilities. Secondly, during this period of total shutdown, the world was overwhelmed by anxiety and fear of the virus. Consequently, the majority of people requiring treatment postponed healthcare services, including maxillofacial treatment.[15,19] Patients were genuinely afraid of being exposed to the virus in hospitals. In their study, Wong and colleagues reported that patients viewed hospitals as infectious reservoirs, “crawling with COVID-19”.[8] The cumulative fear of dentists, of COVID-19 and implementation of travel restrictions provide powerful and justifiable excuses to postpone healthcare services.[20]

Thirdly, the initial shortages in covid tests and the long waiting periods for laboratory results caused unnecessary delays and postponement of urgent maxillofacial treatment. Fourthly, shortages of personal protective equipment (PPEs), critical equipment and consumables had a negative effect on patient treatment and outcomes. During the early phases of the pandemic, the global shortages in PPEs, ventilators and other related equipment had reached catastrophic levels. Despite, instituted rationing, the level of scarcity had an impact on the medical and surgical services.[21] Lastly, delays in the adoption of COVID-19 protocols in our facility contributed to deferrals and postponement of patient treatment. It is only after these constraints were addressed that some form of normalcy was attained and the patient number started to rise. Still, the maxillofacial services have not returned to pre-covid figures.

CONCLUSION

The significant decline in the number of patients treated at our facility highlighted the negative impact of the COVID-19 pandemic on maxillofacial service. Healthcare services are vulnerable to pandemics. Therefore, referral systems and infrastructure must be strengthened to support and maintain patient care beyond tertiary centres.

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The referral system for specialist dental services at Sefako Makgatho Oral Health Centre: a cross-sectional study

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ABSTRACT

Background
The functioning of various referral systems in service delivery at district level have been described.

Aims and Objectives
To examine the functioning of referral system for specialist dental services at Sefako Makgatho Oral Health Centre. The prevalence of self-referrals and emergency patients and reasons for referrals were determined. The pattern of referrals for elective treatment at the clinical units was described.

Design
This was a cross-sectional study

Method
A structured closed questionnaire was used to collect data related to demographic characteristics, reasons for referrals to the clinic and whether patients were referred by healthcare workers or self-referred. Patients themselves or with the assistance of the research team completed the questionnaire. Data required for classifying patients into emergency and non-emergency was gathered from the service register. The classification was made based on the referral preferences of attending clinicians.

Results
A substantial proportion of visitors to the hospital were self-referred (71.3%), emergency patients (69.7%). Among referred patients, the most common reason for referrals was for specialist oral and maxillofacial surgical services. The majority (64.7%) of hospital visitors received elective treatment referrals, 48.9% of which were for general dentistry.

Conclusion
The prevalence of self-referrals by emergency patients is extremely high.

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1. Dr SR Mthethwa: conception; design; acquisition of data; analysis and interpretation of data; drafting the article
2. Dr KJ Ramphoma: conception; acquisition of data and revising the article critically for important intellectual content

Literature review
A hierarchical referral system is followed in the public health sector in South Africa.[1] The functioning of various referral systems in service delivery at district level have been described.[1-3] Very little was found in the literature concerning referral systems and dentistry. A recent national health care facilities audit found that dental services are lacking across the board at primary health care level in South Africa.[4] High attendance rates were reported where services were available and accessible.[5,6] However, the range of services offered was often limited to emergency treatment of pain and sepsis.[7] A compliance audit performed in the district of Umgungundlovu in the province of KwaZulu-Natal found that none of the clinics were compliant with the national set of norms, standards and practice guidelines for primary oral health care.[8]

Sefako Makgatho University Oral Health Centre (SMU Oral Health Centre), a dental school and a comprehensive care referral hospital in the outskirts of Pretoria, is one of two public tertiary care facilities, which are part of an oral healthcare network that includes thirty-three community health clinics, in the Tshwane district.[9] Referral systems for specialist dental services operate between the tertiary care facilities and community oral health/ medical services. Appropriate and timely referral is an essential part of a functioning health system.[10,11] A well-functioning referral system allows for continuity of care across the different levels of care.[12] It ensures that all citizens have access to the highest possible standard of health irrespective of where they access care in the health system.[13] Factors such as accessibility, acceptability, efficiency and effectiveness have been identified as influential in the use of a referral system.[14-16]

At SMU Oral Health Centre new and repeat self-referred and referred patients routinely move between the diagnostic unit, a screening and referral clinic, where experienced dentists examine them and clinical units where dental students under faculty supervision provide treatment or treatment appointments are scheduled.

Emergency patients are triaged based on the severity of their illness, injury or pain and referred to emergency clinics. The attending dentist determines the appropriate treatment and referral options.

- Facial swelling, bleeding (trauma affecting the mouth), an accident involving damage to the mouth or teeth, or dental pain are referred to Minor Oral Surgery/ Maxillofacial and Oral Surgery.
- Restorative emergencies, dental pain and injuries to teeth and the pulp are referred to Care line clinic.

Multiple problems are also assessed. They are however not addressed in emergency appointment -referrals are made to elective clinics at that time. At emergency clinics, the dentist will aim to reduce or stop the pain experienced. Emergency clinics can make referrals to elective clinics. Prosthodontics emergencies are referred to the prosthodontics clinic.

Patients with less urgent problems are referred for general dental care and or for initial assessment in the relevant specialty clinics. They are placed on a waiting list for care and are informed when a booking becomes available.

General dental examinations and care is offered through oral hygiene, minor oral surgery and operative dentistry clinics. This dental service includes routine dental examinations or check-up, oral health advice, scale and polish, extractions, fillings, fissure sealants and root canal treatments.

Referrals for specialist dental services from community oral health / medical services also pass through the diagnostic unit. Specialist dental care is often provided as part of a treatment plan in combination with other specialty clinics.

A recent review of the functioning of referral system that operates between the diagnostic unit and clinical units found it to be inefficient - the average time lapse between consultation at the diagnostic unit and receipt of treatment in clinical units was 81.2 days with a range of just under a week (6 days) to longer than six months (184.5 days). It was also found that patients who presented for emergency treatment constituted 60% of referred patients.[17]

A sharp increase in the numbers of patients who present at the diagnostic unit has been observed - 1209 patients consulted in February 2013[17] compared with 1645 in February 2018[18]. The increase in patients' numbers warranted a study of the effectiveness of the referral system between SMU Oral Health Centre and community oral health/ medical services with a focus on the divide between self-referred and referred patients.

OBJECTIVES OF THE STUDY

- To describe the socio-demographic characteristics of patients who consulted at the diagnostic unit of SMU Oral Health Centre between February and April 2019.
- To determine the prevalence of self-referrals.
- To determine the proportions of emergency and non-emergency patients.
- To describe the pattern of referrals for elective treatment at the clinical units.
- To determine the reasons for referrals between community oral health clinics and SMU Oral Health Centre.

MATERIALS AND METHODS

Study design

This was a cross-sectional study.

Target population

The sampling frame consisted of all patients who consulted at the diagnostic unit of SMU Oral Health Centre between February and April 2019.

Study sample

The ideal sample size was estimated at 300 in Epi Info Version 7.1.0.6 software[19] at the confidence interval of 95% and absolute precision of 5% assuming emergency patients comprise 60% of the total population of 1600.

Sampling method

A systematic random sample was selected i.e. a list of the entire population using hospital registration numbers was prepared in Excel; the sample size of 300 was divided into the total population (1600) to calculate the Kth number (5). A random starting point was selected (a number between 1 and 5). Every fifth person on the list will be selected from the random starting point.[20]

Data collection

A structured closed questionnaire was used to collect data related to demographic characteristics, reasons for referrals to the clinic and whether patients were referred by healthcare workers or self-referred. Patients themselves or with the assistance of the research team completed the questionnaire. Data required for classifying patients into emergency and non-emergency was gathered from the service register of the diagnostic unit. The classification was made based on the referral preferences of attending clinicians.

Definition of variables

Emergency patients are those who consulted at the diagnostic unit with an issue involving teeth and supporting tissues that was fixed/treated at the emergency clinics.

Emergency clinics are clinics where emergency oral and dental treatment is offered. They include the Minor Oral Surgery (MOS), Maxillofacial and Oral Surgery (MFOS), and Care line clinics.

Care line clinic is an emergency clinic where restorative emergencies, prosthodontics emergencies, dental pain and injuries to teeth and the pulp are treated.

Non-emergency patients are those who consulted at the diagnostic unit with less urgent problems, and were placed on a waiting list for care.

DATA ANALYSIS

Data was captured, coded and cleaned in Microsoft Excel software and then transferred to Statistical Package for the Social Sciences (SPSS) software for analysis. Frequencies, means and proportions were calculated. Bivariate analyses were performed. The significance level of the test was a p-value less than 0.05.

Ethical considerations

Only patients who provided informed consent were enrolled. All data collection and analysis and reporting was done without

any personal identifiers. Patients had the opportunity to refuse participation at any time without any repercussion. Ethical approval for the study was granted by the Ethics Committee of Sefako Makgatho Health Sciences University (SMREC/D/309/2018). Permission to conduct the study was granted by the Chief Executive Officer (CEO) of SMU Oral Health Centre.

RESULTS

Data of a systematic random sample of 300 patients was analysed. A response rate of 100% was obtained.

Less than thirty percent (28.7%) of patients who visited SMU Oral Health Centre were referred. The median age of the study sample was 35 years with an interquartile range of 23 to 54 years. Referred patients were younger than self-referred patients (32 vs 37 years).

Female patients constituted the majority of the study sample (62.3%), referred patients (60.5%) and self-referred patients (60.3%). The overwhelming majority (>75%) of patients resided within the catchment area of SMU Oral Health Centre. A little less than two-thirds (64.3%) of patients used taxis to get to the hospital.

The odds of patients forty years of age and younger referring themselves were significantly lower than that for older patients. The odds of female patients referring themselves were higher than that for male patients. The increased odds were not, however, statistically significant.

A little less than seventy percent (69.7%) of patients who visited SMU Oral Health Centre were emergency patients. The median age of emergency patients was five years older than that of nonemergency patients (36 vs 31 years). The proportion of female emergency patients was 20.6% higher than the proportion of male patients. The odds of patients forty years of age and younger being emergency patients were lower than that for older patients. The decreased odds were not, however, statistically significant.

Table 1: Frequency of referred and self-referred patients by socio-demographic characteristics

Variable	Study population (n %) 300 (100)	Referred (n %) 86 (28.7)	Self-referred (n %) 214 (71.3)
Age			
Mean (SD)	38,6 (20,3)	34,1 (16,5)	40,4 (21,4)
Median (IQR)	35 (23-54)	32 (23-44)	37 (25-58)
Gender			
Male	113 (37.7)	34 (39.5)	79 (39.7)
Female	187 (62.3)	52 (60.5)	135 (60.3)
Place of residence			
Within the catchment area of SMU Oral Health Centre	230 (76.7)	53 (61.6)	177 (82.7)
Outside the catchment area of SMU Oral Health	70 (23.3)	33 (38.4)	37 (17.3)
Mode of transport to hospital today			
Walk	12 (4)	2 (2.3)	10 (4.7)
Taxi	193 (64.3)	63 (73.3)	130 (60.7)
Car	81 (27)	15 (17.4)	66 (30.8)
Bus	9 (3)	2 (2.3)	7 (3.3)
Other	5 (1.7)	4 (4.7)	1 (0.5)

Table 2: Bivariate analysis assessing patient socio-demographic characteristics and self-referral

Variable	Bivariate analysis		
	Un-adjusted OR	P-value	95% CI
Age			
40 years and below	0.4851	< 0.01	0.2834- 0.8304
Gender			
Female	1.1173	0.672	0.6684-1.8677

Table 3: Frequency of emergency and non-emergency patients by socio-demographic characteristics

Variable	Study population (n %) 300 (100)	Emergency (n %) 209 (69.7)	Non-emergency (n %) 91 (30.3)
Age			
Mean	38,6 (20,3)	38,9 (18,1)	35,8 (22,3)
Median	35 (23-54)	36 (27-54)	31 (17-55.25)
Gender			
Male	113 (37.7)	83 (39.7)	30 (33)
Female	187 (62.3)	126 (60.3)	61 (67)

Table 4: Bivariate analysis assessing emergency patients and socio-demographic characteristics

Variable	Bivariate analysis		
	Un-adjusted OR	P-value	95% CI
Age			
40 years and below	0.657	0.107	0.394-1.097
Gender			
Female	0.747	0.268	0.445-1.253

Table 5: Frequency of referrals by emergency clinic type

Emergency clinics	Referrals n (%)
Minor Oral Surgery (MOS)	149 (68.3)
Maxillofacial & Oral Surgery (MFOS)	39 (17.9)
Careline	30 (13.8)
Total	218*
*13 (6.2%) patients were referred to more than one clinic: 7 MOS and MFOS; 4 MOS and Careline; 2 MFOS and Careline	

Table 6: Frequency of patient groups by numbers of elective referrals

Patient groups	Numbers of elective referrals			
	Zero n (%)	Single n (%)	Multiple n (%)	Total n (%)
Emergency	81 (38.8)	105 (50.2)	23 (11)	209 (100)_
Non-emergency	25 (27.5)	49 (53.8)	17 (18.7)	91 (100)
Total	**106 (35.3)**	**154 (51.3)**	**40 (13.3)**	**300 (100)**

Table 7: Distribution of elective care referrals among clinical units

Clinical units	Referrals n (%)
Periodontics	34 (14.7)
Operative Dentistry	88 (38.1)
Endodontics	2 (0.9)
Orthodontics	16 (6.9)
Prosthodontics	48 (20.8)
Oral Hygiene	25 (10.8)
Integrated Clinical Dentistry	9 (3.9)
Paedodontics	9 (3.9)
Total	231*(100)
*194 patients received 231 referrals	

Table 8: Categories of referring health workers by occupation

Occupations of referring health workers	Frequency (n %)
Doctor (Medical Practitioner)	12 (14)
Community clinic nurse	4 (4.7)
Dentist	66 (76.7)
Other	4 (4.7)
Total	**86 (100)**

The odds of female patients being emergency patients were lower than that for male patients. The decreased odds were not, however, statistically significant. A little more than two-thirds (68.3%) of all emergency patients visited the Minor Oral Surgery clinic. Slightly more (4%) more patients visited the Maxillofacial and Oral Surgery clinic than the Careline clinic.

A little less than two-thirds (64.7%) of the study subjects received elective treatment referrals. Emergency patients accounted for 66% (128/194) of the referrals. The majority (51.3%) of referrals were to one clinical unit. In contrast, a little more than a tenth (13.3%) of the referrals were to multiple clinical units.

Just less than forty percent (38.1%) of all referrals were to the Operative Dentistry clinic. The second largest number of referrals (20.8%) were to the Prosthodontics clinic. The Periodontics and Oral Hygiene clinics together accounted for 25.5% of referrals. Fewer patients were referred to the Orthodontics (6.9%), Integrated Clinical Dentistry (3.9%), Paedodontics (3.9%) and Endodontics (0.9%) clinics respectively.

Just over three-quarters (76.7%) of all referrals were made by dentists. A significant number were made by medical practitioners. Treatment at the Maxillofacial and Oral Surgery clinic was the most common reason for referrals. Further management at the Minor Oral Surgery and Careline clinics was the reason for a fifth (20.9%) of referrals. The use of diagnostic tools constituted a significant proportion (11.6%) of referrals. Orthodontic treatment accounted for less than a tenth (9.3%) of the referrals

Referral related statistics

Number of referred patients who presented at SMU Oral Health Centre with referral letters: An overwhelming majority (89.5%) of referred patients produced referral letters.

Number of referred patients who understood the purpose of their referral: An overwhelming majority (90.7%) of referred patients understood the purpose of their referral.

Number of referred patients who were instructed to return for ongoing management after referred services at SMU Oral Health Centre: Only a tenth (10.5%) of referred patients were instructed to return for ongoing management after referred services at SMU Oral Health Centre.

DISCUSSION

This study set out to investigate the functioning of the referral system that operates between SMU Oral Health Centre and community oral health/ medical services.

Table 9: Reasons for referrals between community oral health clinics and SMU Oral Health Centre

Reasons for referrals to the clinic	Frequency (n %)
Specialist oral and maxillofacial surgical services	29 (33.7)
Further management at MOS and Careline	18 (20.9)
Use of diagnostic tools (x-rays)	10 (11.6)
Orthodontic treatment	8 (9.3)
Prosthodontic treatment	3 (3.5)
Restorations	6 (7)
Paedodontics	3 (3.5)
Unspecified specialist dental services	4 (4.7)
No reason stated	5 (5.8)
Total	**86 (100)**

Socio-demographic characteristics

The results of this study indicate that more women than men (62.3% female vs 37.7% male) visited SMU Oral Health Centre and that the average age of the study sample was 35 years with an interquartile range of 23 to 54 years (Table 1). The present findings seem to be consistent with other research which found a large female preponderance at dental clinics.[7,21] The age structure of the study population is consistent with that described by Lesolang and colleagues.[7] The results of this study show that the overwhelming majority (>75%) of patients resided within the catchment area of SMU Oral Health Centre and that a little less than two-thirds (64.3%) used taxis to get to the hospital (Table 1). These results are very encouraging for the reason that it is preferable for a patient to be seen at the hospital that corresponds to the patient's catchment area.

Prevalence of self-referrals

The current study found that a little more than seventy percent (71.3%) of patients who visited SMU Oral Health Centre were self-referred and that their average age was 37 years old (Table 1). This result has not previously been described – comparable studies were not found. However, it is significantly higher than the range (35-36%) of prevalence reported at general hospitals in Kwa-Zulu Natal.[22,23] The findings of Masango-Makgobela and colleagues' (2013) study of reasons patients, from the catchment area of SMU Oral Health Centre, leave their nearest healthcare service might explain this result.[24]

They found that 19% of patients who had visited their nearest clinic previously said they would not return. The reasons for this were: long waiting time; long queues; rude staff; and no medication.[24] Considering the number of community health clinics (33) in the Tshwane district, this finding was unexpected. The fact that data was collected during the school term accounts for the high average age of the patients. The most interesting finding was that patients older than forty years of age were more likely to self-refer (Table 2). This result is in contrast to earlier findings at general hospitals in Kwa-Zulu Natal.[22,23]

The current study found that female patients were more likely to self-refer (Table 2). The findings of the current study do not support the previous research at general hospitals in Kwa-Zulu Natal where it was found that the majority of self-referred patients were male.[22,23]

A significant number of referrals were made by medical practitioners. This finding was unexpected and suggests that dental services are lacking at some community clinics.

The results of this study indicate that an overwhelming majority (90.7%) of referred patients understood the purpose of their referral and produced referral letters. These results are very encouraging.

The results of this study indicate that only a tenth (10.5%) of referred patients were instructed to return for ongoing management after referred services at SMU Oral Health Centre. This finding is rather disappointing. It raises questions about how health providers keep track of their patient referrals throughout the care continuum.

Treatment at the Maxillofacial and Oral Surgery clinic was the most common reason for referrals. There are several possible explanations for this result. Coulthard and colleagues (2000) found that the most common reasons for general dental practice referral to specialist oral and maxillofacial surgical services were the expected difficulty of the operation, the medical condition of the patient and the lack of facilities for general anaesthesia.[25] The most interesting finding was that the use of diagnostic tools accounted for just over a tenth of referrals. This finding was unexpected and suggests that some community dental clinics are not fully equipped.

Proportions of emergency and non-emergency patients

The results of this study indicate that a little less than seventy percent (69.7%) of patients who visited SMU Oral Health Centre were emergency patients (Table 3). This finding supports the previous research, which found that emergency patients comprised 59.7% of patients who consulted at the diagnostic unit of SMU Oral Health Centre.[17] However, the ten percent increase in the proportion of emergency patients within 5 years indicates that symptomatic dental attendance continues to be a problem. An implication of this is that the referral system that operates between SMU Oral Health Centre and dental clinics in the Tshwane health district is not effective.

Men were more likely to be emergency patients (Tables 3 and 4). These results differ from previous research by Mthethwa and Chabikuli (2016) which found that female patients constituted 56.8% of emergency patients.[17] Considering the gender distribution of patients in this study (62.3% female vs 37.7% males), it is difficult to explain this result. It is made even more so by the evidence which associates female gender with dental consultations motivated by pain.[26] Further research should be done to investigate this finding.

Patients older than forty years of age were more likely to be emergency patients (Table 4). This finding is in agreement with Nazir's (2018) findings which showed that age over 35 years was a significant factor associated with dental consultations motivated by pain among adult patients.[26]

The majority (68.3%) of emergency patients were referred for elective treatment. The present findings are consistent with earlier findings, which showed that 68.2% of emergency patients required elective treatment.[17]

The current study found that a little more than two-thirds (68.3%) of all emergency patients visited the Minor Oral Surgery clinic. It is encouraging to compare this figure with that found by Mthethwa and Chabikuli (2016) who found that 79.5% of emergency patients in their study visited the Minor Oral Surgery clinic.[17] The current study however produced results which corroborate the findings of a great deal of the previous work in this field i.e. a large number of self-referred emergency patients inappropriately utilising the service for basic curative services i.e. extractions, which could be satisfactorily provided at primary care facilities where available.

The bulk (58.9%) of the referrals were to the Operative Dentistry and Prosthodontics clinics (Table 7). The large number of patients who require general dental care observed in this study reflects the high levels of untreated dental caries reported in studies of dental caries prevalence in South Africa.[27,28]

Limitations of the study

Patient awareness of the referral policy was not investigated.

CONCLUSION

The prevalence of self-referrals to SMU Oral Health Centre by emergency patients is extremely high.

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A Review of the role of Nuclear Medicine Imaging in Diagnostic Dentistry

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ABSTRACT

The increasing scope of nuclear medicine imaging as a diagnostic utility is impressive. Plain film radiographs, computed tomography (CT) scans and magnetic resonance imaging (MRI) diagnostically provide high-quality images but provide little physiological information about disease processes. Nuclear medicine imaging modalities advantageously can characterise the early dynamic physiological changes in a diseased environment. Dental professionals working within the arena of integrated holistic health practices are likely to encounter patients having had procedures like conventional scintigraphy, single photon emission computed tomography (SPECT), hybrid SPECT/CT and positron emission tomography computed tomography (PET/CT). The aim of this review is to acquaint the oral health care professional with some commonly utilised nuclear medicine techniques, the principles upon which such modalities are based and their applications in the diagnosis of head and neck pathology to facilitate enhanced multidisciplinary patient management.

Key words

Nuclear medicine, Dentistry, Head and neck, Positron emission tomography (PET), Single photon emission computed tomography (SPECT), Bone scintigraphy, Lymphoscintigraphy, Hybrid imaging.

INTRODUCTION

With chronicled contributions from the diverse fields of medicine, physics, chemistry, engineering, and mathematics the scope of nuclear medicine is impressive. While extensively used in medical healthcare, the optimal utilisation of nuclear medicine in dentistry remains yet to be widely appreciated. Plain film radiographs, computed tomography (CT) scans and magnetic resonance imaging (MRI) diagnostically provide high-quality images but provide little physiological information about the disease process. Nuclear medicine imaging modalities advantageously can characterise the early dynamic physiological changes in a diseased environment. The application of procedures like conventional scintigraphy, single photon emission computed tomography (SPECT), hybrid SPECT/CT and positron emission tomography computed tomography (PET/CT) in the contemporary diagnostic arena justifies the need for an overview of the utility of nuclear medicine in diagnostic dentistry.

The aim of this review is to acquaint the oral health care professional with some commonly utilised nuclear medicine techniques in the diagnosis of head and neck pathology to facilitate enhanced multidisciplinary patient management.

Nuclear medicine is an independent medical speciality that makes use of radioactive compounds (radiopharmaceuticals) to diagnose and treat disease. Radiopharmaceuticals consist of two chemically bound components, a radioisotope and a tracer. The radioisotope undergoes radioactive decay and is responsible for the diagnostic (photon emission) or therapeutic (particle emission) effect. The tracer targets an organ or metabolic process via a physiological mechanism. In the presence of disease, the tracer will be bio-distributed or metabolised differently. Following administration of the radiopharmaceutical (usually via intravenous injection), gamma rays are emitted from the targeted organ within the patient and are detected by external detectors in the form of gamma or PET cameras. This form of 'emission imaging' is advantageous as it allows for whole-body imaging from a single radiation exposure, with the resultant ability to detect clinically and/or radiologically occult loco-regional and distant disease. Currently, hybrid or multimodality cameras are typically installed in the form of SPECT/CT, PET/CT, and more recently, PET/MRI. Post-acquisition, the anatomical and physiological images are viewed independently and superimposed as 'fused' multi-planar reconstructions. Hybrid imaging provides the 'best of both worlds', combining the high sensitivity of physiologic imaging with localisation and tissue characterisation from the anatomical component. Scintigraphy, SPECT, and PET are established physiological imaging modalities that are principled on the bio-distribution, normal physiological uptake and pathophysiological behaviour of specific radiopharmaceuticals.

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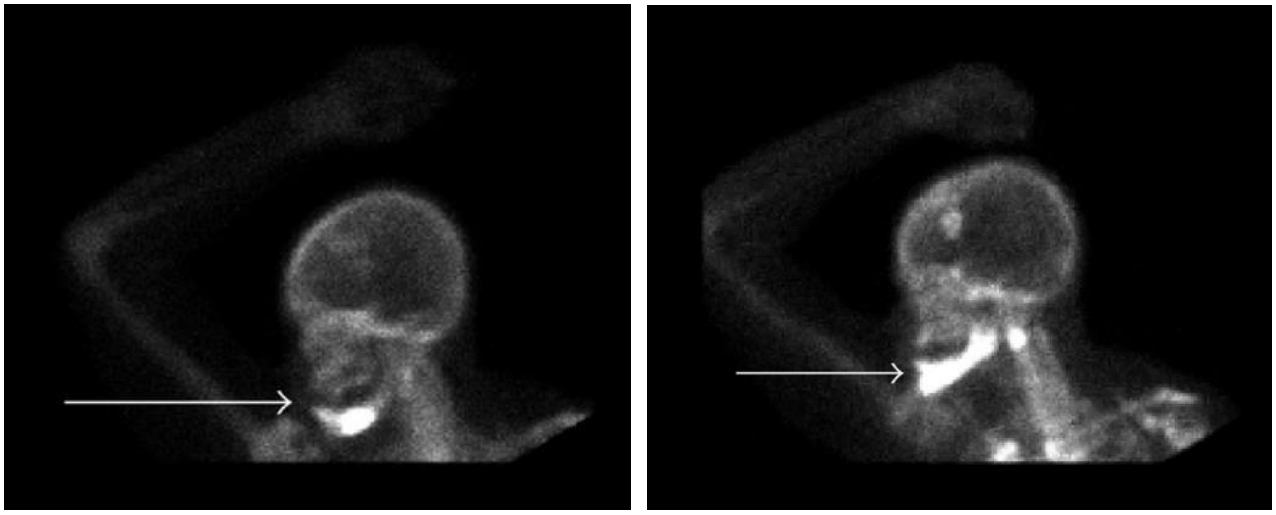
1. **Dr Sandeepa Rajbaran Singh:** First author – contributed to the write-up and editing of the text and images: 50%
2. **Dr Aadil Abdulaziz Gutta:** Second author – contributed to the write-up and editing of the text and images: 50%

Figure 1: MRONJ - Serial lateral static images of the skull from the ^{99m}Tc diphosphonate bone scan of a 61 year old female with metastatic breast cancer being treated with intravenous bisphosphonate therapy (zoledronic acid). The scans demonstrate progressively more intense and extensive abnormal uptake in the left mandible, found to be consistent with osteonecrosis.(Also note the progressive metastatic disease in the left frontal bone and cervical vertebra).



Reference: Bhatt G, Bhatt A, Dragun AE, Li XF, Civelek AC. Bisphosphonate-related osteonecrosis of the jaw mimicking bone metastasis. Case reports in oncological medicine. 2014 Jan 30;2014. Reproduced under Creative Commons Attribution (CCBY) licencing.

Bone Scintigraphy

While CT and MRI have evolved as excellent tools for the evaluation of bone pathology, bone scintigraphy continues to be the second greatest volume nuclear imaging procedure.[1] Characterised by time efficiency, reasonable affordability, wide availability and high sensitivity, scintigraphy is an invaluable diagnostic tool that offers the advantage of total body examination, with a single radiation exposure to the patient. Whole-body imaging facilitates the detection of clinically and/or radiologically occult bony pathology. Scintigraphic images are obtained following the intravenous administration of technetium^{99m} (^{99m}Tc) labelled diphosphonates.

The radiopharmaceutical circulates through the bloodstream and is either incorporated into areas of active bone metabolism or excreted via the urine. Approximately 2-6 hours after administration about half of the injected dose is localised in the skeletal system.[2] The precise mechanism by which the labelled diphosphonates are incorporated into bone remains yet to be elucidated. Bone is continuously remodelled through bone resorption (osteoclastic activity) and bone deposition (osteoblastic activity). Osteoblasts produce an osteoid matrix that is subsequently mineralised with hydroxyapatite crystals. It is thought that the radiolabelled diphosphonates chemisorb and bind to hydroxyapatite crystals in proportion to local blood flow and osteoblastic activity.

Characterised by rapid localisation to bone and a short half-life the diphosphonates are therefore favourable markers of bone turnover and bone perfusion.[3] Lesions can be detected when there is a 5-10% change in bone turnover and the diagnostic value of bone scintigraphy can thus be appreciated when one considers that between 30-50% of alteration to bone content is necessary for detection on conventional radiographs.[4] The high sensitivity does however come at the expense of specificity. Any pathology invoking an osteoblastic response such as infection, inflammation, primary or secondary tumours, metabolic bone disease, or trauma will manifest as increased uptake on a bone scan. Fortunately, in the vast majority of cases, a definitive diagnosis can often be made based on a clinical-pathological correlation. Image acquisition involves a computed gamma camera that records the emitted gamma rays and subsequently generates an image that is displayed and processed on an advanced workstation. Normal scintigraphic findings are described as a symmetric distribution of activity throughout the skeletal system in healthy adults.

Urinary bladder activity, faint renal activity, and minimal soft-tissue activity are also normally present.[2] Areas of increased bone metabolism are scintigraphically demonstrated as areas of increased tracer uptake and are referred to as “hot spots”. Decreased uptake, referred to as “cold spots” are associated with metabolically inactive bone, lack of osteogenesis, or an absent vascular supply.[4] Bone-imaging techniques include standard bone scan (whole body scanning), three-phase bone scan, SPECT and SPECT/CT.[1,4]

The power of the bone scan as a diagnostic modality is most widely appreciated in oncology where it is employed in the detection of primary skeletal tumours and osseous metastases, but other applications include the assessment of bone grafts, acute infection, osteonecrosis of the jaw and condylar hyperplasia. These applications are discussed in more detail below. Malignant bone lesions most frequently present scintigraphically as one or more randomly distributed “hot spots”. The presence of multiple, randomly distributed areas of increased uptake of varying shape, size and intensity are highly suggestive of bone metastases. While these “hot spots” are not specific, their

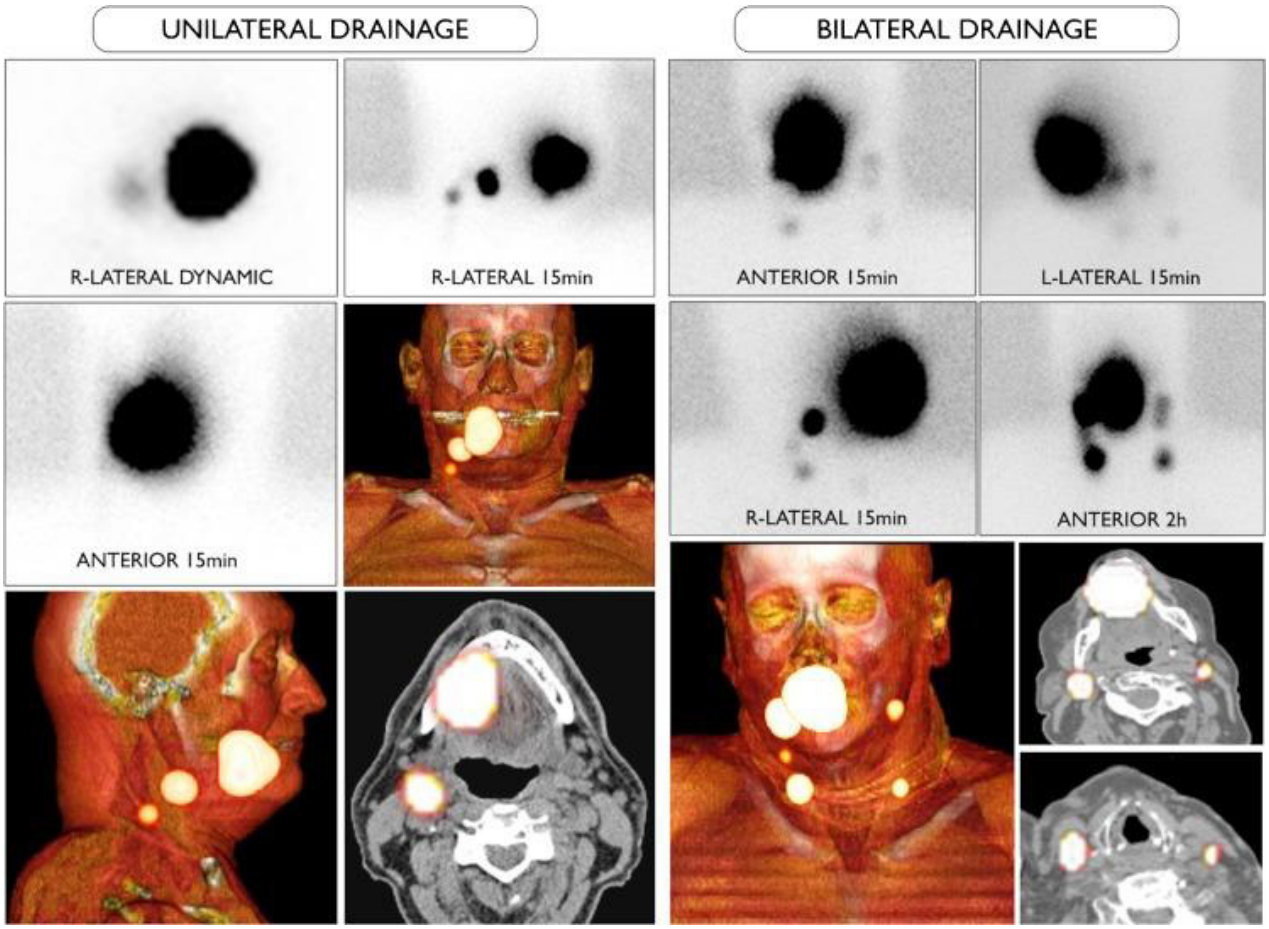
location, intensity, and pattern of distribution are analysed to exclude other causes such as traumatic injury and osteoporosis. The success of osseointegrated dental implants is largely dependent on the quality and amount of bone available for osseous integration. Bone is often grafted to support implants or to replace parts of the jaw marred by periodontal disease, trauma, tumour infiltration, cystic lesions, or congenital defects. Three-phase positive bone scans have been shown to correlate with viable bone grafts thus enhancing prognostication and planning.[5]

In unviolated bone, a three-phase bone scan has high diagnostic accuracy for the detection of acute osteomyelitis and is often positive days or weeks before any changes may be appreciated on plain radiographs. However, in the setting of any underlying bone pathology, the sensitivity of the scan remains high, but the specificity becomes limited.[4] In such cases, second-line infection imaging needs to be performed. In current clinical practice, this involves the use of radiolabelled autologous white blood cells (WBCs), the rationale being that the bio-distribution of activated white cells can be imaged due to their active accumulation at sites of infection or inflammation.

WBCs may be radiolabelled *in vitro* – white blood cells are isolated from a sample of the patients' blood and radiolabelled under aseptic conditions, or targeted *in vivo* with radiolabelled antibodies that bind to antigens expressed by activated neutrophils. The use of regular bone scans as routine investigations for disease progression makes the bone scan an attractive predictive imaging tool for osteonecrosis of the jaw which may be caused by infection, external beam irradiation (osteoradionecrosis), or medication-related (MRONJ).[6]

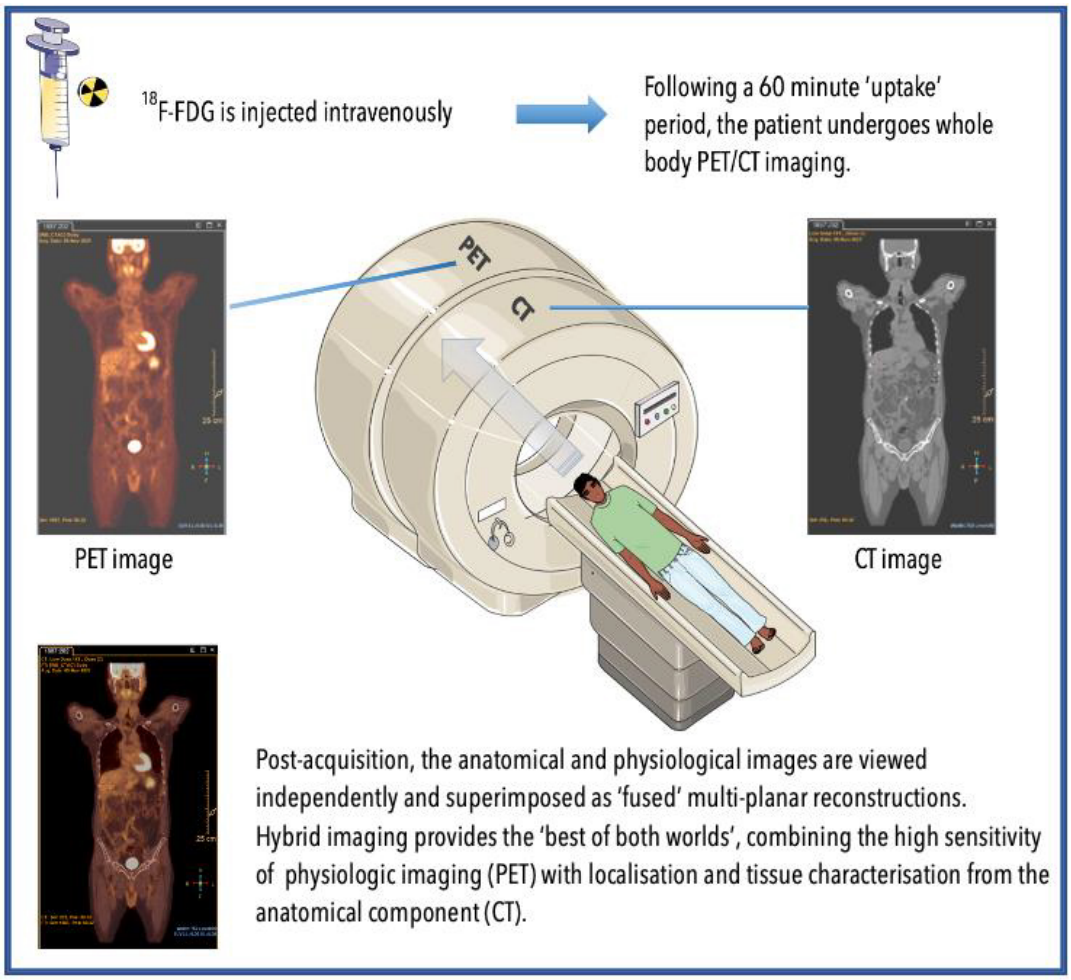
Osteoradionecrosis (ORN) is defined as irradiated bone that fails to heal over a period of 3 months without evidence of residual or recurrent tumour.[7] The incidence of ORN is increasing in tandem with the rise in oropharyngeal cancers. The mean time for the development of ORN following irradiation ranges between 22 and 47 months.[8] Biphosphonate induced osteonecrosis may remain

Figure 2: Lymphoscintigraphy - Sentinel Node Mapping: Lymphatic drainage to the neck is unilateral in a 55-year-old male patient with a T1 primary tumour localized on the right side of the tongue (on the left) and bilateral in a 72-year old female patient with a T1 midline tongue carcinoma (on the right). Note that in both cases the sternocleidomastoid muscle, as depicted on volume rendering and cross-sectional SPECT/CT, is an excellent landmark to anatomically refer the location of sentinel lymph nodes in relation to lymphatic basin and surgical neck level



Reference: Giammarile F, Schilling C, Gnanasegaran G, Bal C, Oyen WJ, Rubello D, Schwarz T, Tartaglione G, Miller RN, Paez D, van Leeuwen FW. The EANM practical guidelines for sentinel lymph node localisation in oral cavity squamous cell carcinoma. European journal of nuclear medicine and molecular imaging. 2019 Mar;46(3):623-37. Reproduced under Creative Commons Attribution (CCBY) licencing.

Figure 3: Diagram illustrating the process of acquiring a hybrid/multimodality PET/CT whole body scan. Diagram produced utilising images from Servier Medical Art (smart.servier.com). Reproduced in compliance with a Creative Commons Attribution (CCBY) license.



asymptomatic for many weeks or months. Bisphosphonates are often used in conjunction with chemotherapy for the treatment of hypercalcaemia associated with malignancy, lytic bone metastasis, and multiple myeloma. Biphosphonates are also frequently prescribed for osteoporosis.

Bisphosphonates bind to osteoclasts in areas of active bone resorption to reduce osteoclastic recruitment; longevity and activity. During the early stages of MRONJ, areas of reduced uptake are consistent with the decreased vascularity of diseased bone.

As the disease progresses, bone scintigraphy can show areas of radionuclide uptake reflective of osteoblastic hyperactivity in a subchondral location.[9] Scintigraphy is thus proposed as a screening tool by some authors to detect subclinical osteonecrosis in patients receiving bisphosphonates (see figure 1).[9,10] Condylar hyperplasia (CH) is a rare bone disorder that is characterised by excessive growth of the condylar process of the mandible. It is typically a unilateral disorder (UCH), with resultant facial asymmetry, deformity, and malocclusion. It usually presents predominantly in female patients during adolescence. UCH is classified as a self-limiting condition and is characterised by a stationary and active phase. UCH is best managed during the stationary phase to prevent further deformity and unnecessary disruption of the TMJ. Functional imaging is uniquely able to differentiate between the two phases based on a qualitative and quantitative assessment of the uptake on the affected side, which will be asymmetrically higher during the active phase with a return to normal during the stationary phase.

Lymphoscintigraphy and Sentinel Node Mapping

Nodal involvement is one of the most important prognostic factors in head and neck cancer. Sentinel lymph node(s) (SLN) refer to the first lymph node(s), in a lymph node group, to receive lymphatic drainage and metastasis from a tumour.

Functional imaging in the form of lymphoscintigraphy utilising radiolabelled nano-particles can identify the SLN, both preoperatively through imaging, and intraoperatively by using a hand-held gamma probe. The aim of lymphoscintigraphy is to 'map' or identify the SLN for intraoperative frozen section and pathological evaluation. If the SLN biopsy is negative, the remaining nodes may not require routine resection which reduces operative and anaesthetic time, intra- and postoperative morbidity, and recovery times. ^{99m}Tc nanocolloid is injected around the tumour and will be carried by lymph to a regional lymph node group and

subsequently retained in the SLN. Regional imaging following injection allows for the preoperative delineation of lymphatic pathways and the SLN. SPECT/CT is particularly useful in SLN mapping with the SPECT component providing the high sensitivity for SLN detection and the CT allowing for anatomical localisation of the lymph node (see figure 2).

PET

PET is principled on the use of positron-emitting radioisotopes. Following intravenous administration and subsequent in-vivo localisation of a radiopharmaceutical, the PET radioisotope undergoes radioactive decay and emits a positron. The positron travels a short distance from the point of decay and interacts with an electron in the orbit of an atom in its path.

The positron and electron undergo an 'annihilation reaction' and produce two gamma photons that travel in opposite directions, which are detected by a PET camera. PET imaging has several inherent advantageous over SPECT. Higher image resolution, sensitivity, and quantification is achieved with PET because of higher energy gamma photons, electronic (rather than physical collimation) and the use of hybrid PET/CT and PET/MR scanners which allow for attenuation correction. Hybrid scanners also improve specificity through accurate localisation of tracer accumulation, tissue characterisation, distinguishing physiologic from pathologic uptake, and verifying a suspicious finding on one modality by confirmation on the other. Commonly utilised PET radioisotopes include ^{11}C, ^{13}N, ^{15}O, ^{18}F, ^{64}Cu, ^{124}I, and ^{89}Zr. These radioisotopes may be used to label more organic compounds (such as glucose, amino acids, neurotransmitters, DNA nucleosides, antibodies etc.), which permit non-invasive, whole body molecular imaging of tumour biology. Molecular imaging has ensconced itself as an essential tool in both the preclinical and clinical setting in oncology, cardiology, neurology, neuroscience and pharmacology.However, the cost and availability of PET/CT remain a challenge, particularly in resource-constrained environments.

Most clinical applications of PET employ the use of flourineflourine^{18}-labeled flouro-2-deoxyglucose (^{18}F-FDG), a radiolabelled glucose analogue.[11] The uptake of ^{18}F-FDG is based on the 'the Warburg effect' - neoplastic cells do not obey normal homeostatic control mechanisms that regulate growth and metabolism, thus they consume large amounts of glucose to fuel their growth and hypermetabolism.[12] ^{18}F-FDG PET/CT is now a key diagnostic tool in oncology, including in (H&N) head and neck cancer (see figure 3).

Initial staging: (see figure 4) As with any cancer, accurate initial staging plays a vital role in management and prognostication. While cross-sectional CT and MRI remain the primary imaging modalities for tumour (T) staging, ^{18}F-FDG PET/CT plays an important role in nodal (N) and metastatic disease (M) evaluation, particularly in more advanced disease or tumours with a high metastatic risk (such as naso- or hypopharyngeal tumours).[13] Furthermore, PET/CT may be beneficial in the setting of metallic artefacts caused by dental restorative materials which may severely degrade the interpretability and diagnostic localisation of CT.[14] The strength of PET/CT in N and M staging lies in its ability to detect disease in normal-sized organs (including lymph nodes), and routine whole body scanning with the capability of detecting clinically and/or radiologically occult distant disease. Accurate N staging is especially important in oral cancer, as the presence of metastatic spread to regional lymph nodes correlates strongly with a poor overall prognosis, an increased risk of

Figure 4: 59 year old male with poorly differentiated squamous cell carcinoma of the right maxillary sinus. Pre-treatment hybrid ^{18}F FDG PET/CT demonstrated intense uptake in the primary tumour (blue arrow) with metastases to an ipsilateral level II cervical lymph node (red arrows).

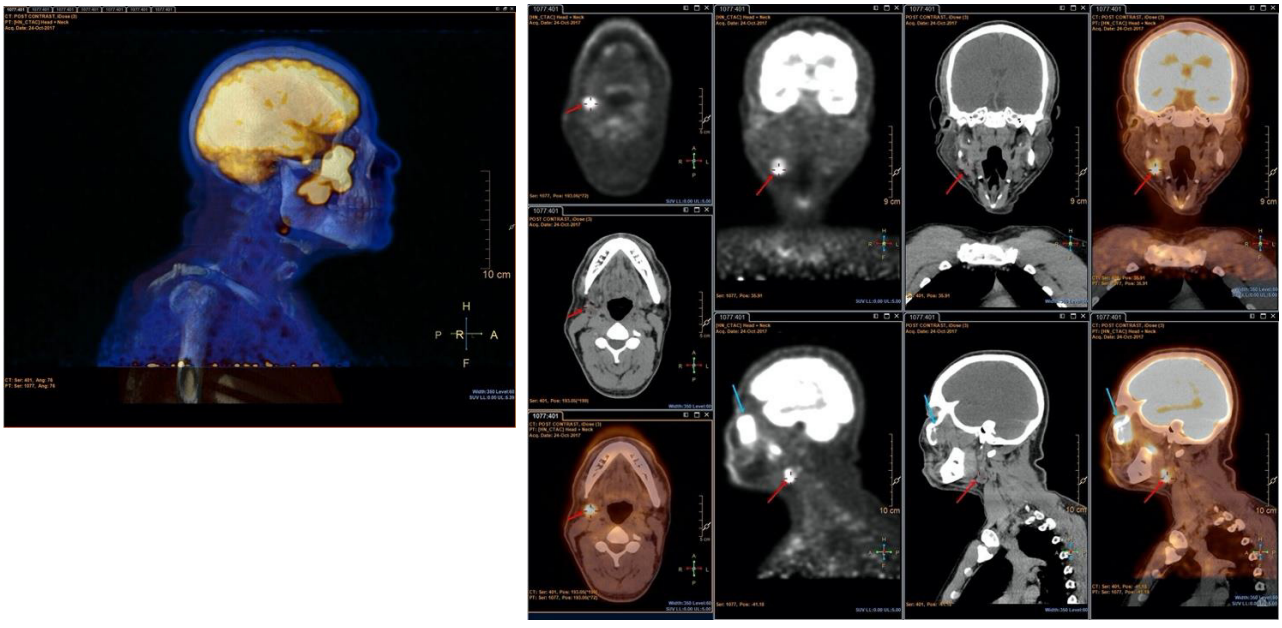


Image: Courtesy of Dr A Gutta, Department of Nuclear Medicine, SMU Health Sciences University/Dr George Mukhari Academic Hospital.

Figure 5: Multi-planar images from the hybrid whole body ^{18}F FDG PET/CT scan of a 72 year old male with a background history of squamous cell carcinoma of the left tonsil. The study was performed 2 years post-surgery and chemoradiation and demonstrated intense uptake in multiple thoracic inlet and mediastinal lymph nodes consistent with metabolically active recurrent disease.

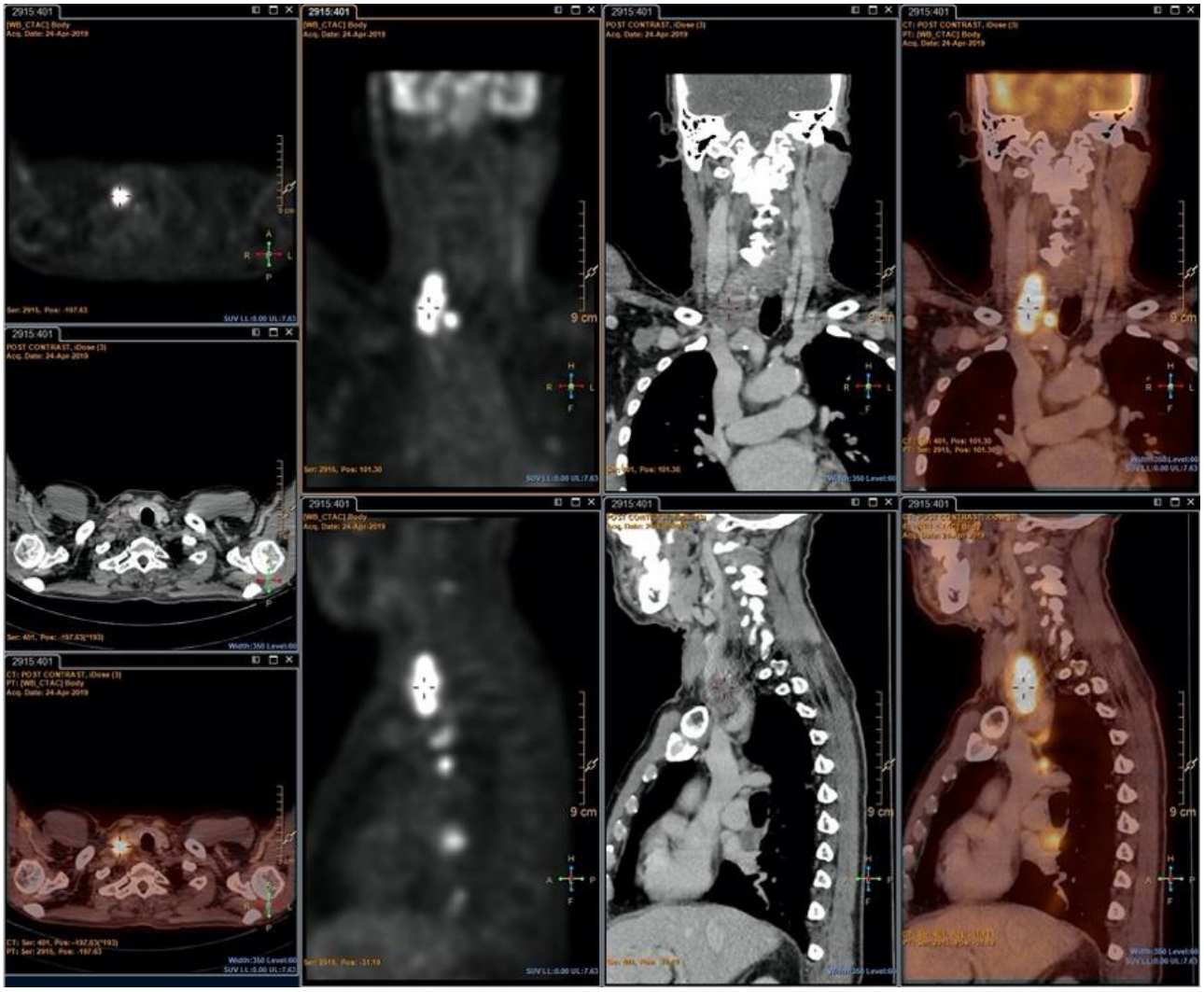


Image: Courtesy of Dr A Gutta, Department of Nuclear Medicine, SMU Health Sciences University/Dr George Mukhari Academic Hospital.

distant metastasis and a reduction in 5-year survival rates by approximately 50%.[14,15]

Detection of synchronous cancers: ^{18}F-FDG PET/CT is more accurate than than conventional imaging in the detection of second primary malignancies and should be considered in selected cases where conventional imaging is negative or equivocal.[16,17]

Detection of recurrence: It may be difficult to differentiate between post-treatment anatomical changes (such as fibrosis or necrosis) and residual and/or recurrent tumour on conventional imaging. ^{18}F-FDG PET/CT imaging relies on a metabolic signal from viable tumour cells. It is therefore reported to be more accurate than anatomical imaging in this setting, especially if conventional modalities are equivocal.[18,19]

Radiotherapy planning: Imaging plays an increasingly important role in radiotherapy planning. There is a growing body of evidence that advocates for the use of ^{18}F-FDG PET/CT to more precisely define tumour volumes, especially in intensity-modulated radiotherapy, where accurate delineation of disease is critical.[20-23] Metabolic data from the PET/CT facilitates the determination of a biological target volume. Modulated therapy can be applied in accordance with metabolic activity within the target volume.[24]

Therapy response evaluation: Accurate assessment of treatment response is essential in the management of patients with H&N cancer. Treatment-associated oedema, hyperaemia, scarring, and the loss of facial planes may make it difficult to differentiate between residual and/or recurrent disease and post-therapy changes on conventional CT or MRI.[25] Conventional imaging relies on size as the most important criterion for response assessment. Limitations in using size include inaccurate response assessment in the setting of residual tumour necrosis and/or fibrosis. Conversely, metabolic response to therapy may be assessed using ^{18}F-FDG PET/CT, where cellular viability is determined from a metabolic signal that is independent of size.

Table I: Summary of Nuclear Medicine imaging modalities, their radiopharmaceutical agents and clinical utility

Modality	Radiophamaceutical	Clinical Utility (Dental)
Conventional Scintigraphy (including SPECT & SPECT/CT)	^{99m}Tc diphosphonates *(e.g. ^{99m}Tc MDP)*	**Bone Scintigraphy** • Metastic work up (osseous) • Bone graft viability • Osteomyelitis • Osteoradiocecrosis • Condylar hyperplasia (unilateral)
	Radiolabelled WBCs (white blood cells)	**Infection & Inflammation imaging**
	Lymphoscintigaraphy (^{99m}Tc nanocolloid)	**Mapping & Radio-guided biopsy of the Sentinel Node**
PET/CT	Positron emitting radiopharmaceuticals (most commonly, ^{18}F-FDG, a radiolabelled glucose analogue)	**Head and Neck cancer** • Staging (esp. N and M) • Detection of synchronous cancers • Detection of recurrence • Radiotherapy planning • Therapy response evaluation • Prognostication • Evaluation of Carcinoma of Unknown Origin (CUP) • Determining optimal site of biopsy

Prognostic value: A meta-analysis assessing the effectiveness of intra- and post-therapy FDG PET/CT in predicting long-term survival outcomes in patients treated for H&N squamous cell carcinoma found that interim and post-therapy PET/CT could accurately predict the risk of death or disease progression after two years and three to five years, respectively.[26]

Detection of recurrence / follow-up: (see figure 5) In patients with H&N squamous cell carcinoma, early and accurate post-therapy diagnosis of recurrence offers the best opportunities for salvage treatment and prognostic prediction. Due to its ability to detect local, regional nodal and distant recurrence, FDG PET/CT is a useful modality for follow-up in these patients.[16,27,28] High cost and limited availability restrict the routine use of PET/CT in this setting, but the study should be considered in patients with a high clinical suspicion in whom conventional imaging is negative or equivocal.

Carcinoma of Unknown Primary (CUP): Despite extensive clinical examination, pan-endoscopy, CT and MRI, the primary tumour may not be detected in 5-10% of patients who present with cervical nodal squamous cell cancer metastases. PET/CT offers an additional 25% detection rate when compared to conventional workup.[29] Lesion detection may be complicated in small volume disease in the primary tumour, normal biodistribution of FDG in the H&N and some tumours have inherently low FDG uptake.[30]

PET/MRI

Hybrid PET/MRI is now approved and commercially available, although current installations are limited due to the high cost and complicated installation. Early studies suggest that PET/MRI performs as well as PET/CT in the staging and restaging of H&N cancer and in radiation therapy planning. The MRI component has the advantages of high spatial resolution and soft tissue characterisation, which may assist in therapy planning, coupled with no ionising radiation, which reduces the radiation burden to the patient.[31,32]

CONCLUSION

Bone scintigraphy, lymphoscintigraphy, SPECT and PET are but a few of the physiological imaging modalities that serve the fundamental purposes of detection, characterisation, and potential staging of disease. Each modality plays a specific role in the diagnostic arena and is best appreciated as a diagnostic tool that is selected to best complement other clinical and laboratory findings. South African public health sector patients often present at initial consultation with advanced disease that is often complicated by infective conditions. Within this resource and financially constrained sector it becomes imperative that oral health care practitioners appreciate the value of appropriate advanced imaging to facilitate cost-effective and efficient treatment. Accurate interpretation of advanced imaging studies requires additional expertise to recognise both normal and abnormal processes in a somewhat larger field of view than in traditional dental imaging systems.[33] In light of advancing diagnostic and treatment methodologies and the interdisciplinary management of patients, it is essential that the dental professional appreciates the applicability of nuclear medicine within his scope of practice.

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Oral and Oropharyngeal HPV prevalence in South Africa

A systematic review and meta-analysis

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ABSTRACT

Background

Prevalence data for HPV infection in the head and neck in Southern African populations is lacking. In addition to cervical cancer, this sexually transmitted oncogenic virus is responsible for a subset of head and neck cancer and is transmitted via oral sexual routes, and through other forms of intimate contact between anatomical sites lined by mucosa. This systematic review and meta-analyses aimed to synthesize data for the prevalence of head and neck HPV infection in South Africa. Original research papers from South Africa reporting on the prevalence of HPV in the head and neck was systematically reviewed using PubMed, Ovid Medline, Embase and the Cochrane Library. A meta-analysis on the prevalence data was conducted for 16 papers that met the inclusion criteria.

Main text

This systematic review and meta-analysis reports a pooled prevalence for head and neck HPV infection of 11%. The study shows both a shortage of, and a data lag for HPV prevalence studies in the head and neck of Southern African populations. Technological improvement over time, differences in data collection methodology, differences in laboratory analysis processes and differences in the selection of study populations including various population risk levels all influence the prevalence measurement outcome.

CONCLUSION

Prevalence reporting for head and neck HPV in South Africa is lagging with only a few reports in existence over a 25-year period. The overall pooled prevalence of 11% is slightly higher than global averages. Populations comprising higher risk groups exhibit higher HPV prevalence rates which is in part influenced by the existence of comorbidities in these groups. Methodologic and study design consistencies and standardization will improve prevalence reporting in this geographic region.

Key Words: HPV prevalence, oropharynx, oral, HPV, human papillomavirus

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Author Contribution Statement:
NHW and JB conceptualized the work. NHW PDM and NLM made substantial contributions to the design of the work. NHW, NLM and PDM contributed towards the acquisition, analysis and interpretation of data. NHW and PDM wrote the first draft. NHW, JB and PDM provided substantial intellectual content and input. NHW, PDM, NLM and JB revised the work critically for important intellectual content. NHW, PDM, NLM and JB gave final approval of the version submitted for publication. NHW, PDM, NLM and JB agree 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.

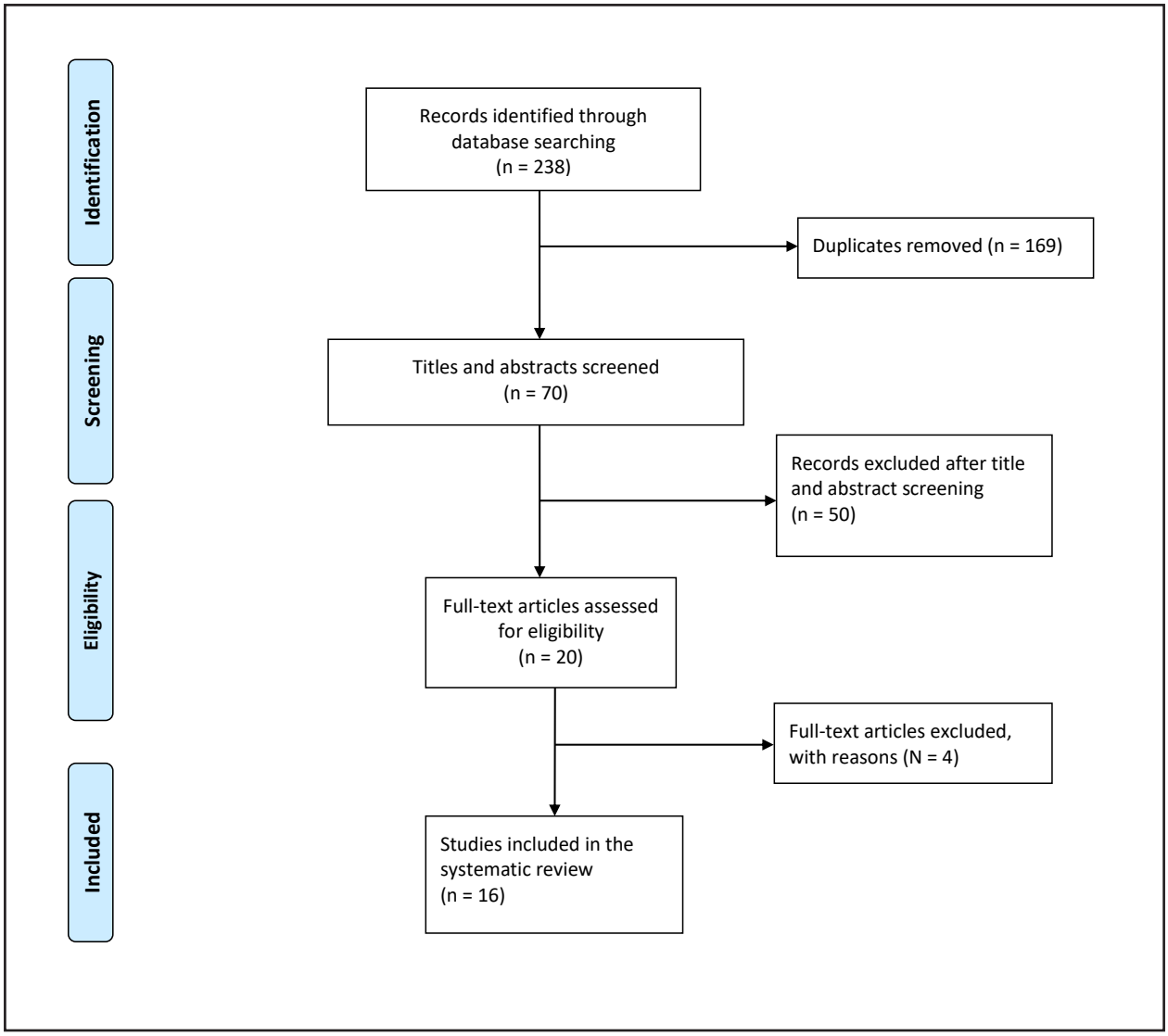
INTRODUCTION

The Human papillomavirus (HPV) is classified as oncogenic to humans (group 1 infectious agent) and the oropharynx is an anatomic site associated with high-risk (HR)-HPV-induced epithelial transformation.[1] This is the most common sexually-transmitted pathogen that includes oro-genital and oral-oral transmission routes.[2] The virus infects exposed basal keratinocytes of a micro-lacerated or abraded mucosal surface.[3]

Clinically productive HPV infection of the skin or mucosae result in benign or malignant lesions. The benign HPV-induced lesions are typically single exophytic proliferations often described as having a cobblestone-like surface or finger-like projections. These lesions are usually of a normal mucosal coloring unless traumatized or secondarily infected.[3] There are also reports that describe HPV association with oral leukoplakic lesions that exhibit dysplastic change, with oral lichen planus and with erythroplakia, although these may represent incidental findings. Associations with malignancies have been reported for cases of verrucous carcinomas.[4-6] However, a subset of head-and-neck carcinomas driven by HPV infection as seen in younger, sexually active individuals is now well recognized.[7-10]

It appears that some HPV types exhibit stronger gender bias than others[11-13], although this association may be artefactual or biased, as many HPV-prevalence studies focus purely on the cervix. In a study from the US, men had three times higher asymptomatic

Figure 1: PRISMA flow diagram detailing literature-search details



HPV infection than women.[14] The reasons for this gender disparity remain unclear.[9]

High-risk HPV-types may be found in benign HPV-associated oral lesions and low-risk (LR)-HPV types may be identified in malignant HPV-associated lesions like oropharyngeal SCC (OPSCC).[15] Some view the presence of HPV in the mouth as being an oral HPV carrier, or as a passenger infection[16-18]; and these individuals are probable transmitters of the virus[19] through oral sex practices and through open mouth kissing among others.[2]

The prevalence of HPV in the mouth and oropharynx has been studied globally, but there is an apparent lack of substantial data from sub-Saharan Africa, and specifically, South Africa. A 2012 systematic review and meta-analysis that reported findings on malignancies resultant from infectious agents also found a significant lack of prevalence studies from developed areas.[20] Only 3 South African studies were included in a 2018 systematic review[9], and the *Human papillomavirus and related diseases report* cited only two South African studies, both dealing with oral/oropharyngeal squamous cell carcinoma.[21]

Given the epidemiologic shift in HR-HPV infection of the head and neck and its closer association with OPSCC[9], it becomes even more urgent to estimate the burden of HPV infection of South Africans in terms of incidence and persistence. The systematic synthesis of these epidemiologic data would improve our understanding of the diseases and of its natural course in this geographic setting.

METHODOLOGY

Search strategy

The Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) was adopted in conducting this meta-analysis. The CoCoPop **(Condition, Context and Population)** framework was adopted to generate the following keywords - **Condition** - Oral HPV, oropharyngeal HPV; **Context** - South Africa, English language; **Population** - Human subjects. Two authors (NHW and LNM) performed searches of PubMed, EBSCOhost, MEDLINE and Embase. For additional articles, grey literature, conference proceedings and reference lists from previously published research were reviewed. To augment the search, MeSH and Emtree subject headings were used individually and in combination.

Table 1: Demographics of populations and methods of included studies.

Study	Date	Site	Population / Sample type	N	% Prevalence (n)	Specimen
Mbulawa et al.[22]	2014	Oral	Heterosexual couples	442	8,4 (37)	Oral brush
Boy et al.[16]	2006	Oral and OP	Tissue	59	11,9 (7)	FFPE tissue blocks
Chikandiwa et al.[23]	2018	Oral and OP	HIV+ Men	181	1,7 (3)	Rinse and Gargle
Muller et al.[24]	2016	OP	MSM	200	11,5 (23)	OP brush
Davidson et al.[25]	2014	Oral and OP	Men	125	5,6 (7)	Rinse and Gargle
Richter et al.[26]	2008	Oral	HIV+ Women	30	20 (6)	Oral brush
Vogt et al.[27]	2013	Oral and OP	Heterosexual couples	68	14,7 (10)	Oral brush
Paquette et al.[18]	2013	OP	Tissue	51	94,1 (48)	FFPE tissue blocks
Van Rensburg et al.[28]	1995	Oral	Tissue	66	1,5 (1)	FFPE tissue blocks
Van Rensburg et al.[29]	1996	Oral	Tissue	146	3,1 (2)	FFPE tissue blocks
Mistry et al.[30]	2019	Oral and OP	MSM	199	6 (12)	Rinse and Gargle
Marais et al.[31]	2008	Oral	Women with cervical disease	105	26,7 (28)	Oral Brush
Marais et al.[32]	2006	Oral	Dental clinic attendees	116	3,4 (4)	Oral Brush
Sekee et al.[33]	2018	OP	Tissue	20	5 (1)	FFPE tissue blocks
Bulane et al.[34]	2020	OP	Tissue	449	7,3 (33)	FFPE tissue blocks
Wood et al.[2]	2020	OP	Dental clinic attendees & HIV+ patients	221	3,6 (8)	Rinse and Gargle

OP = Oropharynx; FFPE = Formalin-fixed, paraffin-embedded

Study selection

Studies were included if they satisfied the following criteria: (i) human subjects, (ii) described the incidence, prevalence of oral or oropharyngeal HPV (ii) South African population. The following studies were excluded (i) systematic reviews, (ii) meta-analyses, (iii) case control studies, (iv) case studies, (v) studies of nonhuman subjects.

Quality Assessment

The study quality was assessed using the Critical Appraisal Checklist for Studies Reporting Prevalence Data published by the JBI. The tool scores the studies on a total score of 9 points, with higher scores indicative of better design and quality. Two researchers (NHW and LNM) blindly performed assessed the studies and assigned a rating of "poor" (≤3), "fair" (4–7), or "good" (≥8) to each study. Only studies achieving a rating of good by both reviewers were included in the analysis. Any disagreement was resolved through discussion between the researchers, or by third reviewer (DPM).

Data Extraction

A form specially developed for this study was used by two independent authors to extract information. The variables of interest included: authors and date of publication; characteristics of the study population (gender, age, sexual orientation); site of sample collection (oral cavity, oropharynx), method of sample collection (oral brush, rinse and gargle, and tissues blocks), prevalence of HPV (crude prevalence and population size).

Data analysis

The measure of effect size (Prevalence of HPV) was computed using the Metaprop command for the meta-analysis of proportions in Stata®. Metaprop is appropriate for proportions, which range from 0 or 100% and guarantees that CIs remain within the 0 to 1 range. This stability is achieved by using the binomial distribution to model within-study variability. In this study, the effect size was calculated together with the corresponding 95% CI using the Wald method executed with the cimethod (score) command. Forest plot was generated to show the individual and pooled effects size, 95% CI, the author's name, publication year and study weights (both for primary studies and this systematic review/meta-analysis), based on subgroups. The random effects model was used to compute the overall estimate of prevalence and the 95% confidence interval. The Cochran's I^2 index was calculated to measure heterogeneity among studies, with $p < 0.05$ indicative of heterogeneity. The I^2 values of <25%, between (25% and 50%), and of >50% reflected, mild, moderate and high heterogeneity respectively.

Subgroup analysis was performed to assess sources of heterogeneity among the studies. Variables included in the subgroup analysis included publication date, site and method of sample collection. Additional sensitivity analysis was done using the "leave-one-out" approach to evaluate the robustness of the pooled results. By removing one study at a time, the weighted or disproportional influence of a single study on the overall prevalence was evaluated. Publication bias was checked by visual inspection of funnel plots of prevalence and precision and statistical tests.

RESULTS

A total of 239 records were obtained from a comprehensive literature search. After the screening of 70 abstracts and titles, 20 full texts were reviewed, of which 16 satisfied the inclusion and exclusion criteria and were included in the analysis (Figure 1). The 16 studies were published between 1995 and 2020 with the total sample size of 2478 and 230 confirmed cases of HPV (Table 1). Larger heterogeneity was anticipated for the small South African data pool.

Heterogeneity assessment

Heterogeneity of the studies was assessed using Cochran's Q and I^2 statistics. The random-effects model was adopted to pool the study-specific prevalence rates

Table 2: Subgroup analysis of oral HPV by site, specimen, and date

Subgroup	(n) studies	Prevalence (%)	95% Confidence Interval	Heterogeneity I^2 (%); p-value
Overall	16	11.0	6.0 – 17.0	95.07; 0.000
Site				
Oral	6	8.0	2.0 – 16.0	91.03; 0.00
Oropharynx	4	27.0	3.0– 62.0	98.49; 0.00
Oral & Oropharynx	6	6.0	3.0 – 10.0	74.50; 0.00
Specimen type				
Rinse & Gargle	4	4.0	2.0 – 7.0	49.21; 0.12
Oral Brush	6	13.0	7.0 – 19.0	85.31; 0.00
FFPE tissue blocks	6	16.0	1.0 – 40.0	97.87; 0.000
Date of publication				
Before 2010	6	8.0	2.0 – 19.0	91.21; 0.000
2010 and beyond	10	12.0	5.0 – 22.0	96.35; 0.000
Sensitivity analysis				
n-1[18]	15	7.0	4.0 – 10.0	85.57; 0.000
n-2[18,31]	14	7.5	5.1 – 11.6	72.13; 0.000

and adjust for variability, attributable to large heterogeneity ($P<0.000$ and $I^2=95.07$). To better understand the methodological and clinical variation we undertook subgroup according to source and type of specimen type, publication date and risk profile.

Subgroup and sensitivity analysis

Prevalence statistics for the pooled HPV studies (n=16), as well subgroup and sensitivity analysis estimates are summarized in table 2. The estimated overall prevalence of the HPV was 0.11 (95% CI = 0.06 - 0.17). The sensitivity analysis was furthered by removing two studies[18,31], which reported significantly higher prevalence and small sample sizes (table 2). Subgroup analyses revealed that HPV was more prevalent in specimens that were sourced from the oropharynx (0.237; 95% CI = 0.059 - 0.67) than in those from the oral cavity (0.072; 95% CI = 0.03 - 0.163), and in the case where specimens were sourced from both sites (0.069; 95% CI = 0.037 - 0.125). Similarly, studies that were published before 2010, reported higher prevalence than the ones published in the last 10 years, (0.237; 95% CI = 0.059 – 0.67) and (0.237; 95% CI = 0.059 – 0.67) respectively. Equally, the prevalence differed according to the level of risk and type of specimen used in the detection of HPV. These proportions did not differ significantly among the subgroups except for specimen type (p=0.044) (Table 2).

The exclusion of the outlier study by Paquette and colleagues[18], resulted in significant decrease in prevalence, (0.07; 95% CI = 0.04 – 0.1) (Table 2). The additional exclusion of study by Marais et al.[31] had a negligible influence of the HPV prevalence rate, (0.078; 95% CI = 0.051 – 0.118). Overall, these two studies resulted in a 33.3% increase in the overall estimate of HPV (7.8% to 10.4%), which provides critical explanation on the source of heterogeneity.

DISCUSSION

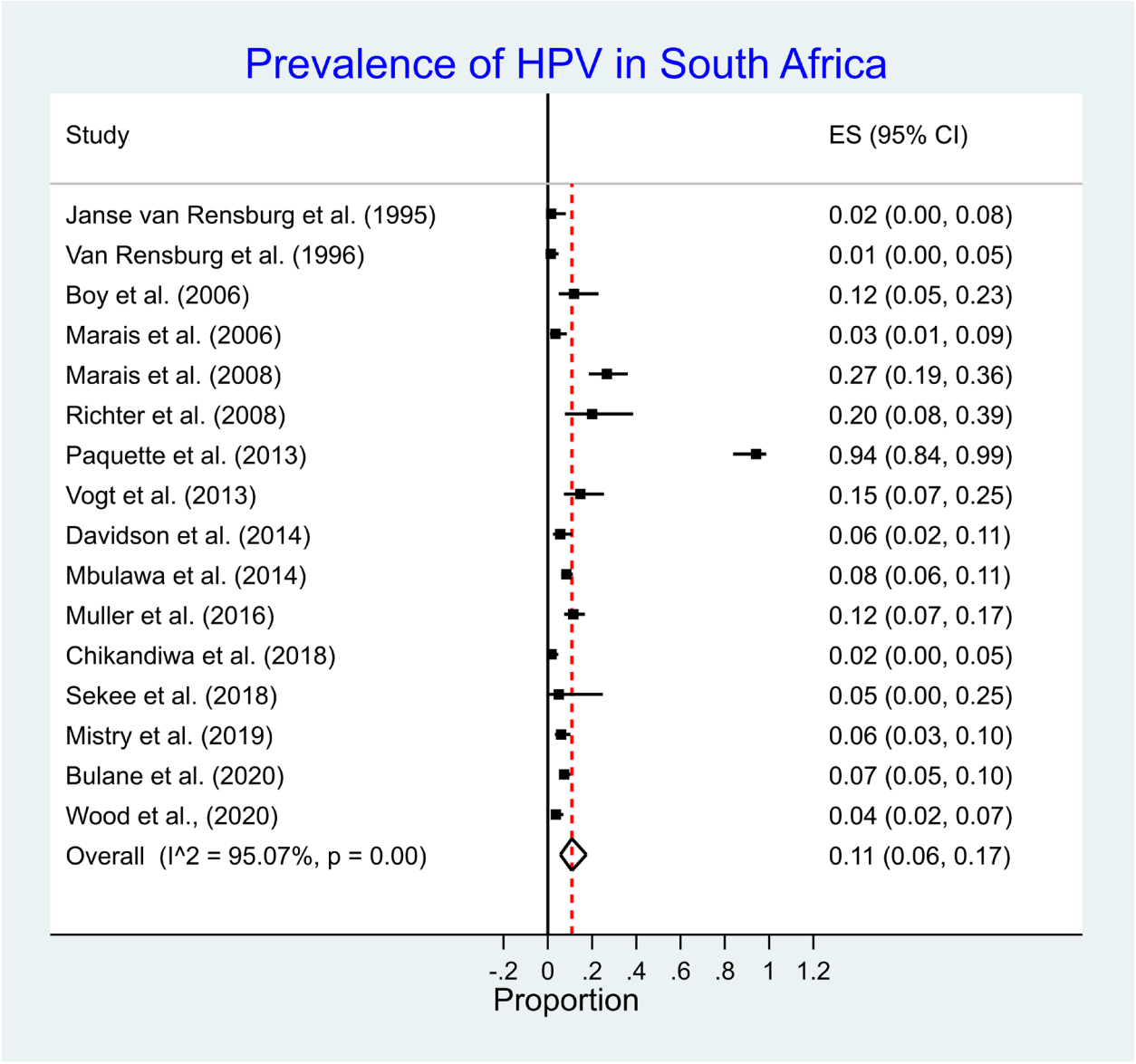
The prevalence of HPV infection of the head and neck is well documented globally.However, these data are not representative of the South African community. Among the reasons for this is the relative lack of analyses from general populations in South Africa, with the bulk of the studies reporting on HPV detection in the head and neck coming from focussed groups, all with varying confounding factors that contribute towards HPV acquisition (Table 1). Several meta-analyses have been done over several years with very few to no papers being included from the South African setting. The 2010 systematic review by Kreimer and colleagues included only one paper from South Africa.[35] The Human Papillomavirus and Related Diseases Report cited 2 South African studies, but these were not included in the 9 studies found suitable to present a picture of the global HPV burden in the head and neck.[21]

The detection of HPV-DNA does not imply infection by HPV but may represent a passenger infection or carrier status. Some individuals may however harbour asymptomatic, but definite HPV infection of which a smaller portion, usually HR-HPV persists, and subsequently increases the risk for malignant transformation.[3,18] Persistence data for HR-HPV infection of the head in neck in South Africans are lacking.

Specimen collection, sampling, analyses methods

Patient demographics, geographic location, population risk profiles, sampling methods, anatomical sites sampled, tissue specimen type and quality, storage and transport, and detection methods all influence the reported prevalence rates of HPV-infection.[3,9,13,26,36] The salivary detection of HPV is influenced by immune efficiency, smoking and the sensitivity and specificity of the PCR-technique applied.[19,37] Detection frequency of different HPV types is also influenced by the specific intra-oral site infected, and the presence or absence of oral diseases such as periodontitis or oral lichen planus that expose basal keratinocytes.[3,38] Oral wash specimens do not allow for oral site discrimination but come into contact with portions of the oropharynx and can therefore not be considered as an exclusively oral specimen.

Figure 2: Forest plot – estimated prevalence of oral and oropharyngeal HPV detection in South Africa



Publication Bias

The risk of publication bias was studied by funnel plot analysis, Egger's test and Begg's correlation. The statistical tests point to absence of bias; Egger's test (p=0.415), Begg's (p=0.293) respectively. We conclude that there is no evidence of publication bias in this meta-analysis. Therefore, the large heterogeneity cannot be attributed to publication bias, but rather to clinical and methodological variations among the included studies.

This meta-analysis validates the impact of various study designs and conduct on the estimation of the prevalence of HPV. The observed heterogeneity can be reasonably attributed to differences in clinical and methodological differences, and to some extent population risk level. The heterogeneity of the published papers makes a meaningful systematic review highly challenging, yet necessary.[13]

Data on HPV-associated malignancies of the head and neck:

HPV-16 carcinogenicity is established for oral/oropharyngeal and laryngeal squamous cell carcinoma (SCC) and is considered a requisite aetiologic factor for a molecular and clinically distinct subset of head and neck SCC.[7,20,21,35] Proportionally, oral/oropharyngeal cancers that originate from HR-HPV infection may be small, but HPV-16 is responsible for the vast majority of these SCC (40-60%).[35,39] Data from the U.S. clearly shows that HPV-driven head and neck SCC has overtaken cervical SCC.[9]

Data on oral and oropharyngeal cancer from Africa is limited when compared to contributions from other geographic regions, and is usually presented as small series.[27,40] A systematic review published in 2013 on prevalence of HPV-infection in oropharyngeal and non-oropharyngeal head and neck malignancies reported no data from Africa and state that the research on HPV-infection in these lesions are needed from Africa.[13] Similarly, the meta-analyses by Dayyani and colleagues[41] and by de Martel and co-authors[20] did not include any data from Southern Africa. The Human papillomavirus and related diseases report[21] cited only two papers[16,29] from South Africa with regard to HPV-associated head and neck SCC further highlighting the lack of reliable data from South Africa.

Evaluation of case-control studies in which tumour tissue was analysed for HPV E6 and E7 oncoprotein expression showed that the HR-HPV was prevalent in 13% of lesion tissue in studies originating outside of North America, Europe, Australia, and Japan.[20] The South African studies reporting HPV detection in oral/oropharyngeal SCC tissue specimens reflect an unfeasibly wide range of 1.4% to 94.1% (Table 1). Due to this high level of heterogeneity, subgroup analysis could not be undertaken to estimate the pooled prevalence of HPV related to the SCC. The prevalence of oral and oropharyngeal mucosal HPV infection remains undescribed for the general South African population, despite the existence of smaller sampled cohorts.

Systematic review

The association between HPV and oral and or pharyngeal carcinoma necessitates the estimation of HPV presence in a variety of population subgroups. Large heterogeneity renders the computation of the summary estimate challenging. The lack of South African data is demonstrated by the effort to consolidate a detailed systematic review from the diverse assortment of study types in the limited pool of contributing studies. The clinical and methodological heterogeneity between the studies included in this systematic review varied greatly. First, the lag bias which is characterised by delayed publication of HPV papers in South Africa extends over 15-year period. This phenomenon could account for differences in diagnostic and identification of HPV as underpinned by advanced in technology and developed protocols. The prevalence of HPV increased from an average of 8.0% in the 1990s to 12.0% a decade later. Six studies compared to ten were published in these respective periods, suggesting the presence of publication bias. Similar findings in the systematic review of 66 papers by Tam and colleagues[9], indicated the increase in HPV prevalence from 3.0% to 7.9% in the 1990's to the 2010's. Secondly, variations in methodologies, population risk profiles and geographic location differences, choice of anatomical sites and specimens, and differences in laboratory investigations may reflect the passage of time, thus further accounting for greater heterogeneity. Despite the design shortcomings, this meta-analysis represents the recent attempt to provide a summarised estimate of the burden of the prevalence of oral and oropharyngeal HPV in South Africa.

The prevalence of HPV detection ranges between 6.2% and 17.7% compared to our estimate of 11.0%.[42,43] However, detection increases when studying groups with associated risk factors for HPV transmission/infection. An HPV prevalence of 10% and more has been reported in studies among high-risk men who have sex with other men and also in women diagnosed with cervical diseases. In HIV-seropositive patients, head and neck HPV-detection can be up to 30%, with chances for oral detection of HPV being up to three times higher in HIV-seropositive patients.[44,45] Benign and potentially malignant oral lesions are associated with HPV prevalence estimates of around 18.6% and 24.5% respectively.[46] Trzcinska and colleagues reported 29% of head and neck squamous papillomas as positive for HPV.[47] The higher approximation of HPV in our study could therefore be attributed to the inclusion of populations at high risk, the deployment of more sensitive diagnostic techniques in the latter decade and increasing the spectrum of any HPV subtype identification. As reported in table 1, the effects of specimen collection and processing, had a major impact on the high HPV estimates and observable heterogeneity.

CONCLUSION

The pooled estimate of 11% from the limited number of South African studies provides a reasonable approximation of HPV prevalence considering the limitations shown in this study. However, when removing one outlier study with considerable weighting, the prevalence rate is significantly reduced to 7%. The increasing prevalence of head and neck HPV among the high-risk groups is attributable to coexistence with comorbidities. The improvement in technology over time has increased the positive detection rate, which could explain the spike in the reported prevalence. This meta-analysis demonstrated the effect of knowledge lag on the estimation of HPV prevalence. To counteract this phenomenon, studies must be standardised and must use the most robust protocols for the detection of HPV. This will permit comparability and computation of reliable estimates of prevalence for the South African population.

Prospective incidence and persistence studies are critical for other vulnerable or high-risk population groups to determine whether preventive vaccination is required, or exclusive vaccination of the female population would confer sufficient protection in these particular groups.

Declarations

Competing interests – Authors confirm that there are no competing interests to declare

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

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Edited and Compiled by Prof V Yengopal, Dean, Faculty of Dentistry, University of the Western Cape, University of the Western Cape

1. Surgical versus non-surgical debridement for the treatment of peri-implantitis

An evidence-based overview on peri-implantitis at the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions concluded the following[1]:

- Peri-implantitis is a pathological condition occurring in tissues around dental implants, characterized by inflammation in the peri-implant connective tissue and progressive loss of supporting bone.
- The histopathologic and clinical conditions leading to the conversion from peri-implant mucositis to peri-implantitis are not completely understood.
- The onset of peri-implantitis may occur early during follow-up and the disease progresses in a non-linear and accelerating pattern.
- Peri-implantitis sites exhibit clinical signs of inflammation and increased probing depths compared to baseline measurements.
- At the histologic level, compared to periodontitis sites, peri-implantitis sites often have larger inflammatory lesions.
- Surgical entry at peri-implantitis sites often reveals a circumferential pattern of bone loss.
- There is strong evidence that there is an increased risk of developing peri-implantitis in patients who have a history of chronic periodontitis, poor plaque control skills, and no regular maintenance care after implant therapy. Data identifying "smoking" and "diabetes" as potential risk factors/indicators for peri-implantitis are inconclusive.
- There is some limited evidence linking peri-implantitis to other factors such as: post-restorative presence of submucosal cement, lack of peri-implant keratinized mucosa and positioning of implants that make it difficult to perform oral hygiene and maintenance.
- Evidence suggests that progressive crestal bone loss around implants in the absence of clinical signs of soft tissue inflammation is a rare event

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Various therapeutic modalities have been suggested to treat peri-implantitis.[2] However, no superiority of one treatment over another could be demonstrated, and more complex approaches have failed to demonstrate additional benefits over simple treatments.[2] Surgical and non-surgical debridement have their own comparative advantages and disadvantages. Flap access provide better visualization and access to instruments in deep and complex defects; however, it demands higher operative time and professional skills and also may lead to high morbidity and costs for patients. Contrarily, non-surgical treatment is simpler for both clinicians and patients, with less treatment time and morbidity. Wagner and colleagues (2021)[2] reported on a trial that sought to compare clinical and radiographic outcomes of surgical and non-surgical debridement for the treatment of peri-implantitis.

MATERIALS AND METHODS

This was a two-centre, parallel-designed, double-blind, randomized controlled trial. To be included in the study, individuals presented with at least one implant with peri-implantitis defined as probing pocket depth (PPD) ≥ 5mm with bleeding on probing (BOP) and radiographic evidence of radiographic bone loss ≥2mm. If an individual had more than one implant with peri-implantitis, all of them were included. In addition to the diagnosis of peri-implantitis, participants were systemically healthy, not presenting systemic diseases/conditions that may have influenced the outcomes of peri-implantitis treatment, such as diabetes, any immunosuppression, HIV infection, osteoporosis, and rheumatoid arthritis. Participants also had a negative history of antibiotic therapy in the previous 6 months preceding the study and did not use anti-inflammatory drugs on a chronic basis. Only partially, edentulous patients were eligible for inclusion. Patients with past history of periodontitis received periodontal treatment at least 3 months before being included in the

study. The following exclusion criteria were applied: use of antibiotics for other infections and development of any systemic condition that could interfere with peri-implantitis treatment

Non-surgical (NST) and surgical (ST) treatments were performed by three periodontists using a standardized approach. Before randomization, all participants received an initial phase of up to four sessions comprised by supragingival scaling of teeth, professional supragingival biofilm removal, and personalized oral hygiene instructions for teeth and implants.

Non-surgical treatment comprised the removal of submucosal biofilm and/or calculus adhered to the implant with Teflon curettes (HuFriedy). When the operator judged that calculus could remain at the implant surface due to robustness or lack of cutting ability of the Teflon curette, a stainless-steel Mini-Five curette (HuFriedy) was gently used to complement debridement. Surgical treatment consisted of biofilm and/or calculus removal but with a full-thickness flap with relaxing incisions for a complete view of all implant surfaces, without removal of soft tissue. No ressective bone surgery or implantoplasty nor any chemical detoxification of the implant surface was performed. The flap was repositioned with silk sutures. In both groups, after removal of the submucosal biofilm, the implant surfaces were irrigated during 1 min with saline solution.

Before starting the interventions, all screw-retained crowns were removed to facilitate access. Cemented crowns were maintained because of the risk of ceramic damage during removal. All patients in both groups were treated under local anesthesia using mepivacaine with adrenaline. Postoperative care included 0.12% chlorhexidine mouthwashes, twice daily, during 7 days after the intervention for both groups. Also, acetaminophen 750mg, each 4 h, was prescribed in case of pain. After the interventions, individuals were followed once a week over the first month. Thereafter, maintenance sessions were made each month during the first 3 months. Over the last 9 months, patients were enrolled in a 3-month recall maintenance program.

During each recall session over 12 months, supragingival biofilm control was checked, and supramucosal professional biofilm removal at the implant sites was performed, together with oral hygiene reinforcement if necessary. At baseline, participants were interviewed using a structured questionnaire containing questions regarding demographic variables, oral hygiene habits, dental treatments, and behavioral factors. Also, all present teeth were examined to register visible plaque, PPD, clinical attachment loss (CAL), and BOP. Implants included in the study were examined at baseline, 3, 6, and 12 months after treatment. A 15-mm manual periodontal probe (HuFriedy) was used to register the following parameters in six sites per implant (distobuccal, buccal, mesiobuccal, distolingual, lingual, mesiolingual): probing pocket depth was measured from the mucosal margin to the bottom of the peri-implant sulcus; and bleeding on probing was evaluated as present if bleeding was evident within 30 s after probing. Also, visible plaque (VP) was recorded. Radiographic evaluation was performed at baseline and after 12 months to assess the radiographic marginal bone level around the implants. All radiographs were digitized in a scanner. One calibrated examiner measured the vertical depth of the peri-implant defect having reproducible landmarks as reference. Specifically, the radiographic bone level was determined as the distance between the implant platform and the most apical portion of alveolar crestal bone, in mesial and distal sites. The reference point in the platform depended on the type of system/connection, always starting at the point where osseointegration may take place

The primary outcome of this study was peri-implant probing depth. Secondary clinical outcomes included plaque and BOP. Also, the change in radiographic marginal bone level (MBL) was calculated by subtracting bone levels at 12 months from that at baseline.

RESULTS

A total of 88 individuals were refereed and screened for eligibility. After exclusions, 48 were randomized. Three individuals gave up participation before treatment due to reasons not related to the study, and 45 were treated (NST=21 and ST=24). The number of implants included in NST and ST was 33 and 30, respectively.

The age of participants was in average 60 years in both groups, and the majority of them were females. There was no significant difference in the distribution of smokers in the two groups. Most of the individuals had only one implant with peri-implantitis. The mean number of present teeth was 22.1 and 23.1 in NST and ST groups, respectively. The periodontal status of participants was stable. There were no significant differences between groups in regard to implant characteristics.

The percentage of sites with visible plaque reduced significantly in both groups after the first 3 months (NST 39.4±8.4 to 13.6±4.5%; ST 30.0±6.5 to 22.2±5.8%) and remained low (NST 11.1±6.0%; ST 12.8±5.1%) until 12 months. For all sites, pocket depth reduced significantly in both groups over time. In the NST group, the significant reduction was seen after the first 3 months (4.14±0.25 to 3.17±0.18mm; $p<0.001$) and slightly increased to 3.39±0.21mm after 6 months, remaining equal to 3.25±0.23mm after 12 months ($p<0.001$). In the ST, pocket depth reduced after 3 (3.73±0.22 to 3.63±0.29mm; $p=0.68$) and 6 (3.33±0.31mm; $p=0.14$) months but without significant difference compared to baseline. After 12 months, the reduction was statistically significant, and PPD equaled 3.03±0.26mm ($p=0.001$). However, there were no significant differences between groups in PPD in any of the timepoints.

For stratified analyses by baseline PPD, the results remained basically the same as those for all sites, without significant differences between the two groups. In sites with initial PPD 5–6mm, PPD reduced from 5.2 to 3.6mm in both groups (within-groups $p<0.001$). PPD for sites ≥7mm reduced from 7.82±0.20 to 5.10±0.30mm in the NST group and from 7.11±0.11 to 5.22±0.91mm in the ST group (within-groups $p<0.001$). The percentage of sites with BOP reduced significantly

in both groups after the first 3 months, equaling 43.4% and 48.9% in NST and ST, respectively, for all sites. At 12 months, BOP was 35% in both groups. There were no significant differences between groups for BOP in any of the timepoints. In moderate pockets. BOP reduced to 42% in the two groups. In deep pockets, BOP was observed in 68.2% of sites in the NST and 55.6% of sites in the ST group after 12 months (p=0.69).

There was no significant difference between groups in the reductions of PPD and BOP for all analyzes. The reduction in PPD in the NST group was 0.83mm higher than in the ST group (p=0.51); however, this difference was equivalent to the baseline difference observed between the two groups.

At the implant level, the percentage of implants that became healthy (negative BOP) after 12 months was 45.5% (95% CI 29.0–61.9) and 50% (95% CI 32.0–67.9) in the non-surgical and surgical groups (p=0.71), respectively. The percentage of implants with PPD ≤4mm and absent BOP after 12 months was 39.4% (95% CI 21.5–57.3) and 46.7% (95% CI 28.6–64.7) in the non-surgical and surgical groups (p=0.57), respectively.

Baseline radiographic bone level equaled 3.39mm and 3.58mm in NST and ST (p=0.67), respectively. After 12 months, there was a significant gain in bone levels for the two groups, but without significant difference between them. When only sites with radiographic bone level ≥3mm at baseline were analyzed, there was a significant difference between groups in radiographic bone levels after 12 months, reflecting a gain of 0.78mm in the surgical group compared to 0.25mm in the non-surgical group (p=0.03).

CONCLUSION

The research team concluded that surgical and non-surgical debridement for the treatment of peri-implantitis were not completely effective to establish peri-implant health. The two treatments provided similar clinical outcomes; however, greater bone gain was achieved after surgical treatment, but the relevance of such difference in terms of implant maintenance needed to be evaluated over a longer term.

Implications for practice: Similar treatment outcomes were achived with a less invasive /more conserbvative approach to implant maintenance/management of peri-implantitis. The potential benefits of the non-sugical approach for the patient (less invasive, costs, time) should

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2. Is there an association between diabetes mellitus and dental/odontogenic infections?

Diabetes is a disease that occurs when the pancreas is unable to produce or use insulin efficiently, resulting in a high blood sugar level. When the body fails to make insulin at all, this results in Type 1 diabetes. With Type 2 diabetes, the body does not produce or use insulin effectively. In addition to typical symptoms such as frequent urination and thirst and unspecific symptoms such as fatigue or recurrent infections, these patients show abnormal blood sugar counts with elevated fasting glucose tolerance above 126mg/dl.

Abscesses are one of the most frequent diagnoses in the maxillofacial practice, with most originating from odontogenic infections. While the vast majority of the cases can be treated sufficiently by a dentist, for example through local incision or calculated antibiotic treatment, some infections tend to progress and form a severe abscess which then requires inpatient treatment with intravenous antibiotic treatment and extended surgical intervention, depending on the abscess' extent, location, and the patients'

The treatment of abscesses is usually not a great challenge nowadays. Yet, some patients show more complicated courses of disease with longer inpatient stays and faster progression of the infection onto different head and neck regions at the time of admission. As diabetes mellitus tends to compromise immune response and therefore makes patients prone to infections, one might expect it to have an influence on abscess formation. T Rahimi-Nedjat and colleagues from Germany (2021)[1] reported on a retrospective study that sought to investigate the relationship between diabetes and severe odontogenic abscesses and whether diabetics show more complicated disease progressions.

MATERIALS AND METHODS

A retrospective case-control study was conducted to test the following hypotheses:

- Patients with a known diagnosis of diabetes mellitus or abnormal glucose tolerance have a higher risk to form a severe abscess than non-diabetics.
- Patients with diabetes-mellitus or abnormal glucose tolerance need longer inpatient treatment. All patients who underwent inpatient treatment due to a severe odontogenic abscess over a seven year period (2010 to 2016) at a Oral and Maxillofacial Surgery unit in Germany were retrospectively included in this study. A severe abscess was defined as any infection exceeding its local borders with wide involvement of soft tissue compartments.

Electronic health records were evaluated for the following details:

- Demographic data such as gender and age
- Location of the abscess

- Diabetes anamnesis (type I or type II)
- Type of diabetes therapy (medicinal or non-medicinal)
- Anamnesis of typical diabetes related illnesses
- Abnormal glucose tolerance was captured by two separate values:
- Maximum blood sugar count (MBSC) during the inpatient stay (a blood sugar count over 200mg/dl at any time was defined as abnormal [9])
- Fasting blood sugar count (FBSC) (fasting blood sugar count was measured only in the morning before breakfast and was defined as abnormal above 126mg/dl [9])
- Duration of inpatient treatment

To be able to compare the data of the abscess patients with those of a general maxillofacial patient group, all cases who underwent inpatient treatment because of any other diagnose during the year 2013 were analyzed as well for criteria mentioned above. All patients who had an incomplete electronic health record for any of the information except the Fasting blood sugar count (FBSC) were excluded from the analyses.

RESULTS

In total, 977 patients with severe odontogenic abscesses were found in the observed period, with a mean age of 41 years (±21.5years). A total of 538 patients were male (55.1%) and 439 female (44.9%). With a mean age of 39.2 years, the female patients were slightly younger than the males, who were 43.2 years old on average (p = 0.004). Most patients who presented with a severe odontogenic abscess were between 20 and 29 years of age (17.1%).

Diabetes anamnesis and blood sugar counts

In the abscess group, diabetes mellitus was confirmed among 7.3% of the 977 patients (n = 71). From these, 6 patients had type I diabetes. Among all 977 patients, an abnormal MBSC was found in 5.7% (n = 56), of whom only 32 (57.1%) were known to have diabetes. This means that 42.9% of these patients had an impaired glucose tolerance but had not been diagnosed with diabetes. Out of all abscess patients, 39 showed an increased FBSC (4.0 %) and of these, 22 (56.1%) already had a diabetes diagnosis.

The mean FBSC for all abscess patients was 114.0 mg/dl and the mean MBSC 112.9 mg/dl. The diabetes patients in this group showed higher blood sugar counts (FBSC 154.5 mg/dl, MBSC 234.1 mg/dl). Of the 71 diabetes patients, 59 received medicinal treatment while 12 managed their diabetes with diet. The most frequent and almost only diabetes-related disease in the anamnesis was nephropathy and could be found in 14 cases. Three more patients had a history of retinopathy and one of neuropathy.

Severe odontogenic abscesses

With 34.1%, the perimandibular compartments were the most frequent localization of severe odontogenic abscesses, followed by the cheek (16.4%), and fossa canina (14.6%). The mean inpatient stay was an average of 6 days (±3 days) for all patients. While there was no significant difference for the hospital stay between diabetics and non-diabetics (p = 0.387, median inpatient stay of 6.4 days), we found a significantly longer hospitalization for patients with abnormal MBSC (p = 0.046, median inpatient stay of 7.5 days) and FBSC (p 0= 0.008, median inpatient stay of 9.2 days).

The investigation of the general group from 2013 involved 2258 patients. These patients had a mean age of 48.0 years (±23.7years). The proportion of diabetics was 5.3% (n=121). Abnormal MBSC was found in 10.7% (n=242) and impaired FBSC in 8.2% (185). Here again these numbers are higher than the number of diabetics since not every patient with an impaired glucose tolerance had been diagnosed with diabetes. For this group, the mean FBSC was 105.7 mg/dl and MBSC was 109.0 mg/dl. These numbers were slightly below those found in the abscess patients.

Comparison of the abscess and general patients

Comparison of the mean ages shows that patients with abscesses were an average 9 years younger than the general group, and diabetics were significantly older than all other patients ($p < 0.001$).

The portion of diabetics among patients under 60 years of age in the abscess group was twice as high as those under 60 in the general group (4.6%, n = 36 versus 2.1%, n = 29). This difference was highly significant ($p < 0.001$). In patients older than 60, these numbers were opposite as the portion of diabetics was higher in the general group with 19.1% compared to 17.7% in the abscess group. However, this difference was not significant.

Finally, adding all patients from both groups into one group and then dividing them into diabetics and non-diabetics allows an examination of the portion of abscesses in both groups. This calculation shows a significant difference, with a higher number of abscesses in diabetics (p = 0.025). An even higher significance was found for those with abnormal MBSC and FBSC ($p < 0.001$).

This relationship could also be observed in the odds ratio. The occurrence of a severe abscess in diabetics was 1.28 times more likely than in non-diabetics. This number was even higher for diabetics with impaired FBSC (2.51) and for those with abnormal MBSC (2.7).

CONCLUSION

The researchers found that abscesses are more likely to occur in diabetics and that diabetics who had poor medicinal or dietary treatment proved to have the highest odds of forming a severe abscess from a dental infection.

Implications for practice: Almost half of the patients with impaired blood sugar values did not have a diabetes diagnosis in this study which should also serve as a warning in our country that has one of the highest rates of diabetes among adults in the world. Patient history taking is crucial to identifying this group that has no knowledge of their blood sugar counts that presents for treatment. Caution and extra vigilance should also be key in managing patients with known diabetes.

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Maxillofacial Radiology 195

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ODONTOGENIC MYXOMA OF THE MAXILLA

A 48 year old asymptomatic male patient presented with a mass on the left maxilla with a reported awareness of two years. Clinical examination revealed normal mucosa overlying buccal and palatal swellings in dental region extending from the 23 to 27. Tooth 26 was missing and teeth 24, 27 and 28 demonstrated displacement.


Fig 1

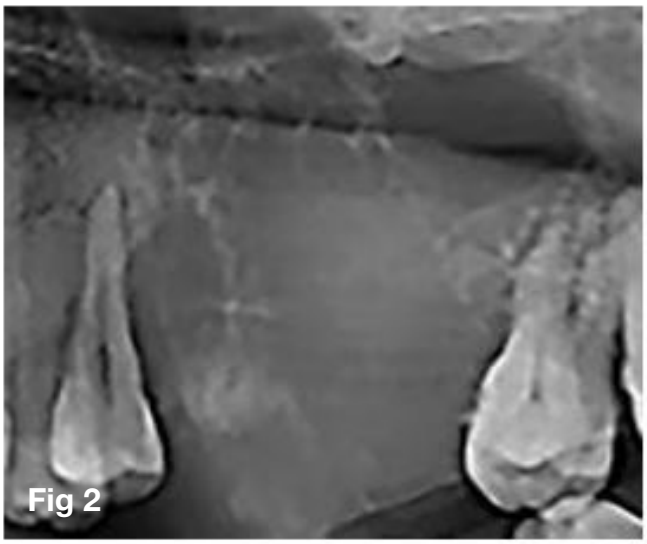
Fig 2

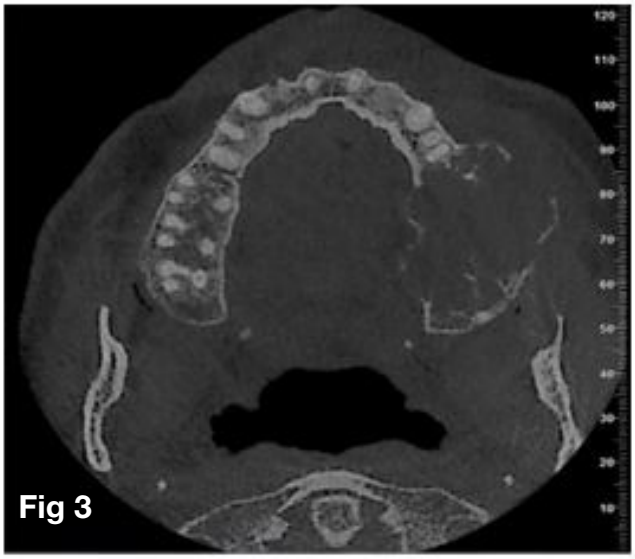
Fig 3

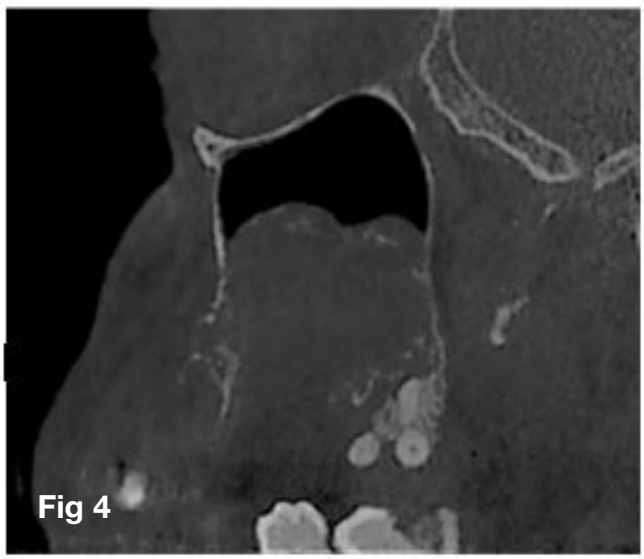
Fig 4

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A panoramic radiograph (Figure 1) demonstrated an ill-defined radiolucent lesion of the posterior maxilla extending from tooth 25 to tooth 28, with a missing tooth 26. Within the lesion, thin wispy radiopaque septae converging at right angles imparted a “tennis-racket” multi-locular appearance (Figure 2). A radiographic impression of an odontogenic myxoma prompted further Cone Beam Computed Tomography (CBCT) scan. Axial views (Figure 3) demonstrated an expansive lesion causing thinning of cortical plates with focal areas of perforation. Sagittal views (Figure 4) demonstrated destruction of the sinus floor with infiltration of the inferior aspect of the maxillary sinus by a lobulated mass within which there are sparse trabeculae.

Based on clinical presentation and radiographic appearance diagnoses of the lesion differentially included odontogenic myxoma, ameloblastoma and calcifying odontogenic cyst. Histopathological interpretation confirmed the lesion to be an odontogenic myxoma.

Odontogenic myxomas are benign, slow growing and locally aggressive odontogenic neoplasms bearing histological similarity to pulpal ectomesenchyme.[1,2,3] With higher relative frequencies reported regionally in Asia, Europe and America, the global prevalence of odontogenic myxoma varies between 0.04 and 3.7%.[2] Since initial description, several studies have reported variable radiographic features that overlap with benign and some malignant lesions.[4] Radiographically, lesions appear as radiolucent or of mixed density. Lesional borders may be corticated, non-corticated, poorly defined, or diffuse. Larger lesions have been reported as multilocular while smaller lesions are reported as being unilocular. Arrangement of septae of residual bone within the lesion imparts patterning that has been described as honeycomb, soap bubble-like or resembling a tennis racket.[5,6,7] The locally invasive nature of odontogenic myxoma is attributed to the expression of proteinases causing enzymatic degradation of extracellular matrix. This destruction is evident in the posterior maxilla when lesions demonstrate invasion of the maxillary sinus or the perforation of bone. The spectrum of clinical and radiological presentations justifies the timely review of this entity to enhance diagnosis, treatment planning and overall patient prognosis.

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Children's Rights and Oral Health

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ABSTRACT

Despite clear legal promulgations by section 27 of the Constitution and Children's Act 38 of 2005, the best interests of children are generally undermined or ignored. The lack of respect for the rights of children is difficult to quantify; the extent to which "children are seen and heard" is under-reported. Culture, religion, patriarchy and socio-economic condition are among the factors that exacerbate blatant disregard conditions for children's rights. Health care professionals are not adequately informed about the rights of the child and how to ensure that their interest are protected during oral health care. Consequently, children may suffer neglect and harm during dental care. Practitioners must familiarize themselves regarding their responsibilities and roles when treating children. Additionally, teaching institutions and regulatory bodies must provide continuous professional development on legislation that regulates the protection of children within health care service. This case study seeks to provide a legal framework for oral health practitioners when dealing with consent for minors during dental care.

BACKGROUND

It is not uncommon for clinicians to be drawn into custody battles, when dealing with minor children. In most instances, the clinician will refer such matters to the CEO or delegated hospital manager to supersede and authorise dental treatment. This article seeks to answer the following questions: How are such conflicts managed in solo practices or in settings without delegated, independent and accountable senior manager? When are clinicians obligated to respect parental or guardian's rights upon the child? Clinicians should have sufficient understanding of the constitutional provisions as well as laws that provide for protection of children.[1,2] Irrefutably, all legal provisions regard the interests of children as paramount.[3] Hence the appointment of the High Court, as an absolute guardian to always act to protect the child's rights in cases of conflict. The law takes centre stage as an unbiased arbiter to assure that decisions taken are always in the best interest of the child. Naturally, parents or guardians might hold particular biases about what is the "best" interest of the child; and in case of conflicts, these opposing interests might potentially harm the child if not managed decisively and timeously. Clinical situations may drastically deteriorate, when a minor requiring urgent medical care, experience undue delays. Furthermore, clinical indecision and legal deferment could seriously compromise the prognosis, clinical outcomes and quality of life.

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1. **M E Mogodi:** 35% Conceptualization, writing edition and final review
2. **M I Makoea:** 35% Conceptualization, writing edition and final review
3. **P D Motloba:** 30% Conceptualization, writing edition and final review

Case scenario

An 11 year-old girl, was referred from a local clinic to maxillofacial hospital for further management following a fall from a bicycle. The clinical examination revealed that she had suffered a horizontal maxillary Fort I fracture resulting in separation of her hard palate from the upper maxilla.

The attending clinician recommended immediate reduction of the fracture under general anaesthesia. The accompanying adult, her biological father seemed hesitant to give consent for the surgery, despite having clearly understood the risks and benefits associated with the procedure, as well as the urgency and the consequences of no treatment. On further questioning he said that a few weeks earlier he had been deemed ineligible to consent for his daughter's treatment because they do not share the same surname. At this time the child's mother had to be called to give consent. It emerged that the mother had been married to her current spouse for 8 years and the child lived with her biological mother and stepfather. At the time of the accident, the child had been visiting her biological father, who was recently been released from prison after serving a 10-year jail sentence. Given the urgency of the operation, and the unavailability of the mother, the stepfather was summoned to give consent for the surgery, however, the biological father opposed the authority and delegation of the stepfather. Finally, the hospital superintendent authorised the surgery. The child was successfully operated, discharged and recovered very well

DISCUSSION

In the case of the 11 year old girl, surgery proceeded without any complications. Legal and ethical questions arise given what transpired during this encounter:

(i) Which of the parents have the right to consent for child.
(ii) How should the conflict between parents be resolved?
(iii) How would a clinician ensure the best interest of child under their care?

(i) Critical Notes on the *Children's Act* 38 of 2005

The standard of "the best interests of the child" is the measure entrenched in the Children's Act and the Constitution.[4,5] This comprehensive law has gone through two iterations, and has repealed over six acts relating to children.[6] This act was reformed in order to regulate consent for treatment of children.[7] Notably, the repealed *Child Care Act* of 1983, made provision for children above the age of 14 and 18 to consent to medical and surgical operations respectively.[8] These laws were viewed as limiting the children's rights to participate in decisions about their health.[7,9,10] Hence, the current *Children's Act* 38 of 2005 prescribes the responsibilities and rights of the parents, caregivers and the court of law over the child, and the decisional capacity of the child. The *Children's Act* provides for guardians to consent for medical intervention for children.[6,8] However, parental responsibility and rights are not absolute, and can be limited if found to be unreasonable.[10] The question is who has delegation of authority to consent for this child?

(ii) Responsibilities and Rights of Parents[11,12]

Both parents have full parental rights and responsibilities and may consent individually to child's medical treatment or surgery. It is incumbent on consenting parent to consider views and expressions of the other, especially where a decision could significantly have an adverse effect on the child's health. A biological mother automatically assumes full parental right and responsibilities irrespective of her marital status. Similarly, the act confers equal parental rights and responsibilities to an unmarried father, as long as they are committed to the upbringing and caring of the child. Categories of parents excluded by the act, include: (i) biological parent of a child conceived through rape or incest; (ii) any person who is biologically related to a child by reason only of being a gamete donor for purposes of artificial fertilisation; and (iii) a parent whose parental responsibilities and rights in respect of the child have been terminated. In respect of common law, an adoptive parent in a marriage assume parental rights and responsibilities by virtue of marriage.

(iii) Responsibilities and rights of caregivers

Caregiver is any person who cares for the child, including grannies, aunts and other relatives who take responsibility over the child. The consent to care for the child may be given by the child's parents, a foster parent, or any person authorised to do so. Caregivers are authorized to give consent for the child only if the child is under the age of 12 or lacks the capacity and mental maturity to consent.

(iv) Roles of the court

In the event that, the parent or guardian are unavailable or untraceable, then the Minister of Social Development or the Court of Law can be approached to give consent. This process can take time. There is legal precedence on the court acted as the upper guardian in the protection of the best interests of the child. *In S v Makwanyane; Christian Education South Africa v Minister of Education* 2000 (4) SA 77757 *and in ex parte Thulisile Sibisi* , the courts upheld decisions in favour of the child.

(v) General principles and children's rights

The guiding principles on matters related to the child are to protect the well-being and the best interest of the child, respect child agency by involving them in decision-making. To determine what is "in the best interest of the child", the following factors must be considered: - *Section 7(a)(i)* nature of the personal relationship between child and parent or guardian; *S7(g)(i)* age, maturity and stage of development; and *S7(h)(1)* the child's physical and emotional security and his or her intellectual, emotional, social and cultural development.

According to *Section 10* "Every child that is of such an age, maturity and stage of development as to be able to participate in any matter concerning that child has the right to participate in an appropriate way and views expressed by the child must be given due consideration". Therefore, the right of a child to participate in decision-making should be respected even if the child is not of legal consenting age.

Section 129(b)(c) provides that a child may consent if he/she is of sufficient maturity and has the mental capacity to understand the benefits, risks, social and other implications of the treatment and for a surgical operation, the child is duly assisted by his/her parents or guardian" and minor children aged 12, and 14 years can consent for medical and surgical procedures respectively.

In this scenario, which parent has the primary right to consent for her treatment, the biological father or the stepfather? According to the Act, any parent, biological or adoptive may hold parental rights and responsibilities. *Section 21* of the act confers parental rights to unmarried father, provided the following conditions are met; (i) he consents to be identified as a father, either by paying damages (customary law), by applying to the court. (ii) he has contributed or attempted to contribute to the upkeep and maintenance of the child in good faith and for a reasonable period.

The biological father served a 10-year prison term, and he did not support his child in any way during this period. Damages were paid and rituals concluded for the child on her 2nd birthday, whilst still in jail, he failed on four components of parental responsibilities and rights, that is (i) care of a child, (ii) contact with a child, (iii) acting as a guardian of a child and (iv) contributing to the maintenance of a child. It is evident that the biological father would not enjoy the legal parental rights, without commensurate responsibilities. It is possible for the courts to restrict, terminate or suspend parental rights in such cases.[10] The practitioners who previously questioned the legality of the biological father's authority to consent for the child were therefore justified. It is incumbent of health professionals to question relationships of children and guardian, as suspicion can avert cases of child abuse and harm.

The stepfather should enjoy full parental rights over the child, he is married to her mother and has taken responsibility for her upkeep, care, contact and maintenance for over 8

years. This case highlights that sharing a surname is legally and inherently immaterial to confer parental rights over a child. Clinicians cannot take it at face value that parents who share or do not share surnames have absolute right to consent for the minor's treatment. Dental professionals need to be sceptical and suspicious about relationships between children and guardians. Deeper interrogation is necessary in cases where the child may seem uneasy around a guardian. Such interventions could avert cases of child abuse; neglect and trafficking.

Disputes between consenting parents can be a challenge for all involved in the child's care. It is important for health professionals to focus only on the welfare of the child and to avoid irrelevant matters such as marital differences.[13] If the dispute is over an elective procedure, the medical team must not continue with the procedure without the order from the court. In case of medical emergency, the Super-intended, or a person in charge of the medical facility, can consent on behalf of the child, only if:

(a) The treatment or surgery is needed to save the child's life or to prevent serious injuries or disability, (b) It is urgent that there is no time to seek consent from the people authorized to give consent. Both requirements must be met in compliance with the Act.

Implications for practitioners

Clinicians like other sectors of society are duty bound to protect the health care rights of the vulnerable, especially children. Specific to oral health, the following rights should be guarded by those providing this essential service.

i) Clinicians must maintain objectivity to ensure that children's rights to oral health are not subverted by third party interest, i.e parents, guardians or caregivers. In so doing, the practitioner must ensure that competent children are involved in decision making about their oral health care needs. Where possible and appropriate, children must be given an opportunity to make inputs about the treatment they will receive.

ii) Ensure that children enjoy access to preventive; promotive and curative services. It is incumbent on clinician to provide and advocate for increased access to these services.

iii) Law is not stagnant, therefore it is critical for clinicians to familiarize themselves with the current legislation that promotes the rights of children and inculcate them in their daily practice.

CONCLUSION

Familiarity of health professionals with the Children's Act is critical in ensuring that "best interest of children" is realised during oral health care services.

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CPD questionnaire

SEFAKO MAKGATHO HEALTH SCIENCES UNIVERSITY

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

GENERAL

Oral and Oropharyngeal HPV prevalence in South Africa

1. Choose the CORRECT answer. In this systematic review, the overall pooled prevalence for oral/oropharyngeal HPV detection is:
   A. 9%
   B. 10%
   C. 11%
   D. 13%

2. Select the CORRECT statement. When Human papillomavirus is detected in a patient's mouth or oropharynx, it could mean the following:
   A. The patient will develop clinically visible lesions within the next 6 months
   B. Detection of HPV-DNA may represent a passenger infection or carrier status
   C. Patient will have to undergo systemic screening for HPV infection
   D. None of the above

3. Which of the following statements regarding Human Papillomavirus (HPV) is CORRECT.
   A. Human papillomavirus is responsible for a large percentage of oral and oropharyngeal ulceration
   B. Oral HPV infection will only be detected in women with existing cervical HPV infection.
   C. Human papillomavirus has an association with a subset of oropharyngeal carcinomas
   D. All of the above are correct

A Comparison of Convergence Angles of Crown preparations in an undergraduate programme at a Tertiary Institution

4. Select the CORRECT answer. What is retention feature of a restoration?
   A. The features of a tooth preparation that enhances the stability and durability of a restoration.
   B. The continued possession, use, or control of something
   C. The ability of a restoration to withstand removal forces along the long axis
   D. The minimal taper of axial walls of a preparation

5. Which of the following is CORRECT. The convergence angle of a tooth preparation is defined as
   A. The maximal cervical-occlusal height of a tooth preparation
   B. Divergent taper of axial wall preparations.
   C. Maximum convexity of the preparation
   D. Combined taper of opposing axial walls.

6. Which of the following statements is CORRECT. Adequate axial wall taper is important because?
   A. It decreases the strength of the restoration.
   B. Improves physical retention and increase resistance of the restoration.
   C. Compromises structural durability of the restoration.
   D. It can induce pulp devitalisation.

7. Select the CORRECT answer. What is the theoretical recommended ideal convergence angle?
   A. 8° to 12°
   B. 3° to 14°
   C. 10° to 22°
   D. 4° to 6°

8. Choose the CORRECT option. Excessive crown preparation taper can induce?
   A. Reduced retention,
   B. Cement bond failure
   C. Pulp devitalisation
   D. All of the above

Association of parental factors and delayed dental care for children

9. Which answer is CORRECT. What are endodontic procedures performed to achieve apical closure in permanent teeth are referred to as?
   A. 52 million hours in productivity time
   B. 77 million hours in productivity time
   C. 81 million hours in productivity time
   D. 350 million hours in productivity time

10. Choose the CORRECT statement from the following:
    A. Illness precedes the social and cultural factors
    B. The enabling logistical factors are the means to access health services
    C. All of the above statements are correct
    D. None of the above statements are correct

11. Select the CORRECT statement. Which National Department of Health goal has South Africa not reached?
    A. To have at least 50% of children under the age of 6 years being caries free.
    B. To have at least 60% of children under the age of 6 years being caries free.
    C. To have at least 80% of children under the age of 6 years being caries free.
    D. To have at least 90% of children under the age of 6years being caries free.

12. Choose the CORRECT option. Which healthcare utilisation model was adapted as the framework for this study?
    A. Aday and Andersen healthcare utilisation model
    B. Andersen and Newman healthcare utilisation model
    C. Rosenstocks' healthcare utilisation model
    D. Econometric model of healthcare utilisation

13. Which of the following is CORRECT. What is the prevalence of dental caries in South African children?
    A. 60%
    B. 80%
    C. 50%
    D. 90%

The impact of covid-19 lockdown on maxillofacial related services at tertiary dental institution.

14. Select the CORRECT answer. Which of the following have been found to be the most cost-effective interventions against the spread of COVID-19?
    A. Vaccinating the population against COVID-19
    B. Social distancing, wearing of masks and handwashing
    C. Steaming with boiling water and social distancing
    D. Rinsing nose with saline and adding pepper to soups and food.

15. Choose the CORRECT option. What was the most performed dental procedure during the pandemic?
    A. Root canal treatment
    B. Biopsies
    C. Incision and drainage of dental abscesses
    D. Dental extractions

16. Which of the following is CORRECT. What was the reason for consultation for most of the patients visiting maxillofacial department during the pandemic?
    A. Impactions
    B. Pathology
    C. Trauma
    D. Infection

17. Select the CORRECT option. What interventions can improve access to maxillofacial services during pandemics?
    A. Employ more healthcare professional
    B. Strengthen referral and infrastructure systems
    C. Free transportation to health care facilities
    D. Introduction of home based care facilities

The referral system for specialist dental services at Sefako Makgatho Oral Health Centre: a cross-sectional study

18. Select the CORRECT answer. The prevalence of self-referrals at SMU Oral Health Centre during the study period was
    A. 41%
    B. 51%
    C. 61%
    D. 71%
    E. None of the above

19. Which of the following is CORRECT. The prevalence of emergency patients at SMU Oral Health Centre during the study period was
    A. 39%
    B. 49%
    C. 59%
    D. 69%
    E. None of the above

20. Select the CORRECT option. The most common reason for referrals to SMU Oral Health Centre was
    A. Specialist oral and maxillofacial surgical services
    B. Further management at MOS and Careline
    C. Orthodontic treatment
    D. Prosthodontic treatment
    E. Restorations

ETHICS

21. Select the CORRECT answer. What ethical principle is violated when parental disagreement compromises the child's dental treatment
    A. Autonomy
    B. Fidelity
    C. Veracity
    D. All of the above

22. Choose the CORRECT answer regarding consent for child's dental treatment
    A. Clinicians are likely to be drawn into custody battles when dealing with treatment of minor children
    B. Mothers as primary care givers have more rights than fathers to consent for child's dental treatment
    C. Only children who are South African citizens have the right to access health services
    D. None of the above

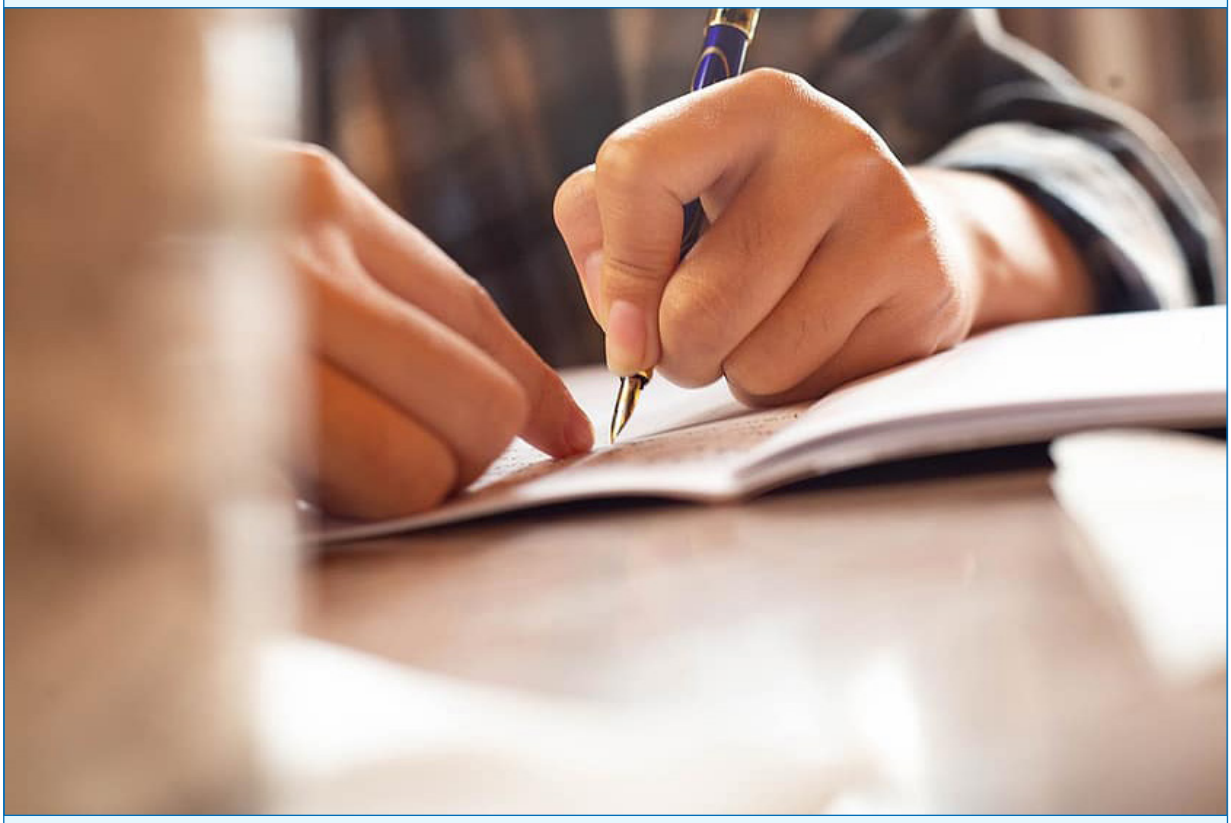
23. Which of the following options is CORRECT. To ensure the "Best interest of the child" means that
    A. Health care practitioners should respect parents of minor children and acknowledge their responsibility to make decisions for their children's health
    B. Health care practitioners should respect minor children as persons and acknowledge their intrinsic worth, dignity and sense of value
    C. Health care practitioners should recognize the human rights of all South Africans
    D. All of the above

24. Select the CORRECT statement. Who has the responsibility and rights to give consent on behalf of minor children below the age of 12?
    A. Biological parents
    B. Biological parents or Adoptive parents
    C. Biological parents, Adoptive parents or Caregivers
    D. Biological parents, Adoptive parents, Care givers, Superintended or Court of Law

25. Choose the CORRECT answer from the following statements
    A. The Children's Act does not confer automatic equal parental rights and responsibilities to an unmarried father
    B. Parental responsibility and rights and are absolute, and cannot be limited
    C. A biological mother does not automatically assume full parental right and responsibilities if they are not married
    D. In the event that, the parent or guardian are unavailable or untraceable, then the Minister of Social Development or the Court of Law can be approached to give consent

Online CPD in 6 Easy Steps

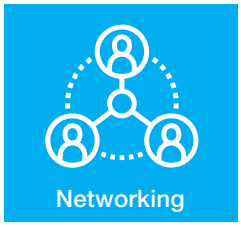
The Continuous Professional Development (CPD) section provides for twenty general questions and five ethics questions. The section provides members with a valuable source of CPD points whilst also achieving the objective of CPD, to assure continuing education. The importance of continuing professional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



1 Go to the SADA website www.sada.co.za.
2 Log into the 'member only' section with your unique SADA username and password.
3 Select the CPD navigation tab.
4 Select the questionnaire that you wish to complete.
5 Enter your multiple choice answers. Please note that you have two attempts to obtain at least 70%.
6 View and print your CPD certificate.

SADA Virtual Congress and Exhibition Report

SADJ November 2021, Vol. 76 No. 10 p652 - P656



OVERVIEW

The SADA Dental & Oral Health VIRTUAL Congress and Exhibition took place on Friday, 27 August 2021, until Sunday, 29 August 2021, its one-year hiatus due to the coronavirus pandemic.

The objective of this event remained about the promotion of learning and gave dentists a platform to bring forward new ideas and techniques at every level within the oral health fraternity.

Creative Space Media, the official congress virtual PCO 2021, made use of the Hopin platform offering exposure and connectivity to all role players in dentistry in South Africa to reconnect with industry peers.

The three-day event included a full and informative schedule with prominent speakers from the dentistry industry both locally and internationally.

Virtual Conference

For the first time, the SADA Dental & Oral Health Congress and Exhibition was held VIRTUALLY, creating a collaborative platform for delegates, traders and speakers to join together worldwide in a circle of learning.

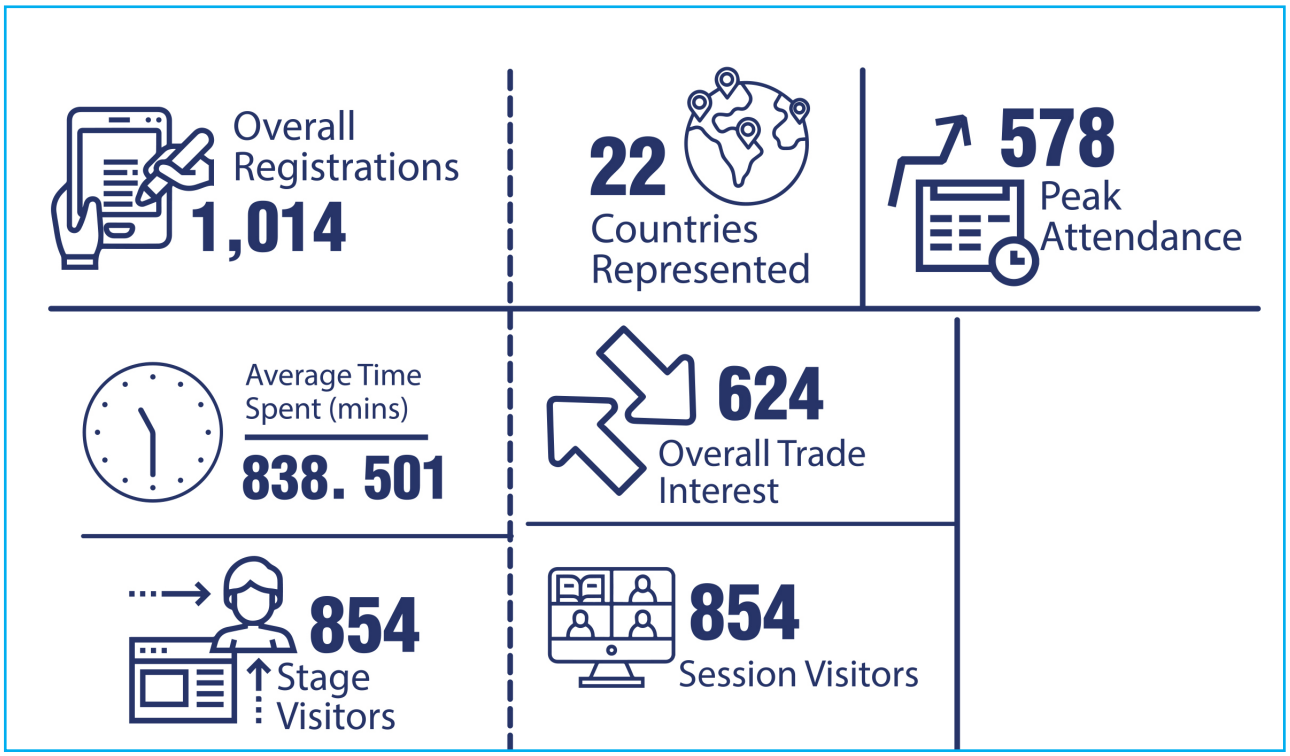
Networking

Interaction via live chat allowed audience members to post public comments and enabled delegates to branch off into private chats thereby creating unique digital networking opportunities for strategic partnerships.

Live Q & A

Each Masterclass or Keynote Address was followed by a live Q&A where all speakers were joined by a facilitator who steered an intriguing conversation between the speaker and the delegate.

EVENT STATISTICS



SPEAKER STREAMS

Trade Registration Partner

SENSODYNE

FRIDAY, 27 AUGUST 2021 – MASTER CLASSES

Streams	Morning: 09:00 - 12:00 Afternoon: 13:00 - 16:00	Speakers	Topic
Facilitator - Dr Rugananthan Reddy			
Stream 1	**Morning & Afternoon**	Dr Ian Corbett & Dr Christiaan Victor	Lecture 1: Local Anesthesia Evidence-Based Success (Repeated) Lecture 2: Minimal Invasive Endodontics **(Sponsored By Henry Schein Dental Warehouse)**
Facilitator - Dr Nthabiseng Metsing			
Stream 2	**Morning**	Prof Peet van der Vyver	Masterclass And Live Case Demonstration Illustrating Direct Resin Placement Techniques In The Posterior Dentition **(Sponsored By Dentsply Sirona)**
Stream 2	**Afternoon**	Prof Peet van der Vyver	Masterclass And Live Case Demonstration Illustrating Modern Concepts In Endodontics For Maximum Preservation Of Tooth And Root Structure **(Sponsored By Dentsply Sirona)**
Facilitator - Dr Tinesha Parbhoo			
Stream 3	**Morning & Afternoon**	Dr Kris Chmielewski	Codiagnostix And Guided Surgery - Why Do I Love This Combination? (Repeated) **(Sponsored By Straumann Group)**
Facilitator - Dr Boela van der Merwe			
Stream 4	**Morning**	Dr Mark Cronshaw	Clinical Perio, Peri-Implantitits & Aesthetic Tissue Control With A Scoop Of Pbm (Photobiomodulation) **(Sponsored By Scivision Medical & Dental)**
Stream 4	**Afternoon**	Dr Justin Kolnick	Addressing Clinical Endo Complications With Laser-Assisted Technology **(Sponsored By Scivision Medical & Dental)**
Facilitator - Dr Mark Bowes			
Stream 5	**Morning & Afternoon**	Dr Stefen Koubi	Teamwork In Everyday Practice : Cosmetic /Worn Dentition /Implant. A Guided And Predictable Approach Between The Dental Clinician And The Dental Technician. (Repeated) **(Sponsored by Ivodent)**
Facilitator - Dr Yvette Solomons			
Stream 6	**Morning & Afternoon**	Dr Riccardo Tonini & Dr Seedat Hussein	1. Shaping: How To Deal With Complex Anatomies Preserving The Original Path From Style Italiano (120 Min) (Repeated) 2. The Bioceramic Wave In Endodontics (60 Min) (Repeated) **(Sponsored by Wright-Millners)**

Facilitator - Dr Howard Gluckman			
Stream 7	**Morning**	Dr Dominic O'Hooley & Dr Peter Jm Fairbairn	Immediate Tooth Replacement In A General Dentists Practice **(Sponsored By Southern Implants)**
Stream 7	**Afternoon**	Dr Costa Nicolopoulos & Dr Petros Yuvanoglu	Accelerated Implant Treatment **(Sponsored By Southern Implants)**
Facilitator - Dr Nathan Vermaak			
Stream 8	**Morning**	Dr Hlombe Makhuluma, Dr Thembeka Buleni, Dr Sindiso Nkosi, Mr HP Toerien	Own Your Profession **(Presented By YDC)**
Facilitator Dr Thembeka Buleni			
Stream 8	**Afternoon**	Dr Andre El Zoghbi	Quintessential Aligner Concepts For Predictable Treatment Planning **(Sponsored By Spark)**

12:15 – 12:45	Mr Jarryd Gillmer	Alternative Investments For Professional Clients **(Sponsored By Everest Wealth)**

SADA DENTAL & ORAL HEALTH VIRTUAL CONGRESS AND EXHIBITION
Back to the future: Excellence in Dentistry 27-29 AUGUST 2021

SATURDAY 28 AUG (MAIN PODIUM)

Time	Saturday 28 Aug (Main Podium)	Topic
Facilitator - Dr Mark Bowes		
08:00 - 08:45	Dr Kyle Stanley	The Dark Side Of Dentistry
09:00 - 09:45	Dr Peter Miles	Orthodontic Mythbusters (Hosted by SASO)
Facilitator - Dr Nthabiseng Metsing		
10:30 - 11:15	Dr Derek Mahony	Identifying Airway Problems And The Increased Risk For Serious Oral And Systemic Health Problems, In Your Dental Patients
11:30 - 12:15	Dr Tony Rotondo	Limitations Of Large Composite Restorations
Facilitator - Dr Mark Bowes		
13:00 - 13:45	Dr Mirela Feraru	Harmonizing Smiles In Challenging Aesthetic Treatments
14:00 - 15:00	Dr Miguel Stanley	Slow Dentistry: How Seeing Fewer Patients A Day Is The Best Strategy For Long-Term Success
15:15 - 16:00	Dr Ricardo Mitrani	Terminal Dentition…Where Do We Draw The Line?

SPECIALIST GROUPS PARALLEL SESSIONS

Time	Specialist Groups Parallel Sessions	Topic
Facilitator - Dr Vyonne Hoods-Moonsamy + Dr Yvette Solomans		
APSA (14:00 - 16:00)	Dr David Chvartszaid	Lecture 1 - Immediate Placement And Loading Of Implants In The Anterior Maxilla.
APSA (16:00 - 17:00)	Prof Peter Owen	Lecture 2 - The Complexity Of Care And The Dunning Kruger Effect.
Dr Howard Gluckman & Dr Sankeshan Padayachee		
SASPIO (14:00 - 17:00)	Dr Ricardo Kern	Phenotype Modification Induced By Connective Graft - Scientific Evidence And Clinical Tips For Aesthetic Results And Periodontal Health

SUNDAY 29 AUG (MAIN PODIUM)

Time	Sunday 29 Aug (Main Podium)	Topic
Facilitator - Dr Mark Bowes		
08:00 - 08:45	Dr Alasdair McKelvie	Your Dentolegal Questions Answered **(Dental Protection)**
09:00 - 09:45	Prof Dale Howes	Myths And Mysteries In Occlusion
Facilitator - Dr Nthabiseng Metsing		
10:30 - 11:45	Panel Discussion Facilitated By Prof Yangopel & Prof Wood - Presenters Prof Ahmed Bhayat, Dr Sagwati Golele And Dr Thabea Tladinyane	The Oral Disease Burden In South Africa - What Should Private Practitioners And/Or Dental Organisations Do To Have An Impact?
Facilitator - Dr Mark Bowes		
12:00 - 13:00	Dr Feheem Bhamjee & Dr Ridhwaan Haffajee	Prosthetically Driven – Surgically Enhanced Treatment Execution
13:00	**Close**	

SUNDAY 29 AUGUST / AUXILIARY GROUPS PARALLEL SESSIONS

Time	Auxiliary Groups Parallel Sessions	Topic
Facilitator - Ms Kaokie Sepuru		
OHASA (11:00 – 13:15)	Dr Alasdair McKelvie, Dr Yash Naidoo, Dr Jeanne Oosthuysen	Dentolegal Dilemmas Workshop **(Dental Protection)**
Facilitator - Dr Nthabiseng Metsing		
DENTAL ASSISTANTS (08:00 - 08:45)	Mrs Melanie Savvides	Let's Talk About Infection Control
DENTAL ASSISTANTS (08:45 - 09:30)	Mrs Elize Jacobs	Be A Rock Star At Work
DENTAL ASSISTANTS (09:30 - 10:30)	Dr Jonathan Du Toit	Sterile Surgical Protocol For Daily Dental Practice
Facilitator - Dr Tinesha Parbhoo		
SADTA (11:00 - 11:45)	Mr Lesley Naidoo	The Impact Of Sour Candy On Tooth Enamel
SADTA (11:45 - 12:30)	Mr Bradley Poovan	The Evolution Of Composite Restoration
SADTA (12:30 - 13:15)	Ms Desiree Govender	The Dental Superheroes Guide To Practice Management

Time	Speakers	Topic
Facilitator - Ms Kaokie Sepuru		
GSK Private Chat Room (Sunday 08:00 - 09:00)	Dr Andreas Siebold & OHASA	Aetiology And Treatment Of Dental Hypersensitivity Due To Recessions
Facilitator - Dr Alasdair McKelvie		
Dental Protection Clinic (Sunday 09:15 - 10:15)	Dr Alasdair McKelvie, Dr Raj Rattan, Dr Yash Naidoo	Ask Us All

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The VIRTUAL congress continued with its preceding standard enabling delegates to select which lecture they wished to attend – having the opportunity to learn from esteemed international and local industry peers

Friday Peak Attendance

Main Stage	83
Stream 1	256
Stream 2	163
Stream 3	206
Stream 4	163
Stream 5	181
Stream 6	66
Stream 7	106
Stream 8	209

Saturday Peak Attendance

Main Stage	352
Stream 1	185
Stream 2	125

Sunday Peak Attendance

Main Stage	456
Stream 1	201
Stream 2	139

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BREAKDOWN OF CATEGORIES	
TITATNIUM	1
PLATINUM	1
GOLD	7
SILVER	26
ESSENTIAL	7

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