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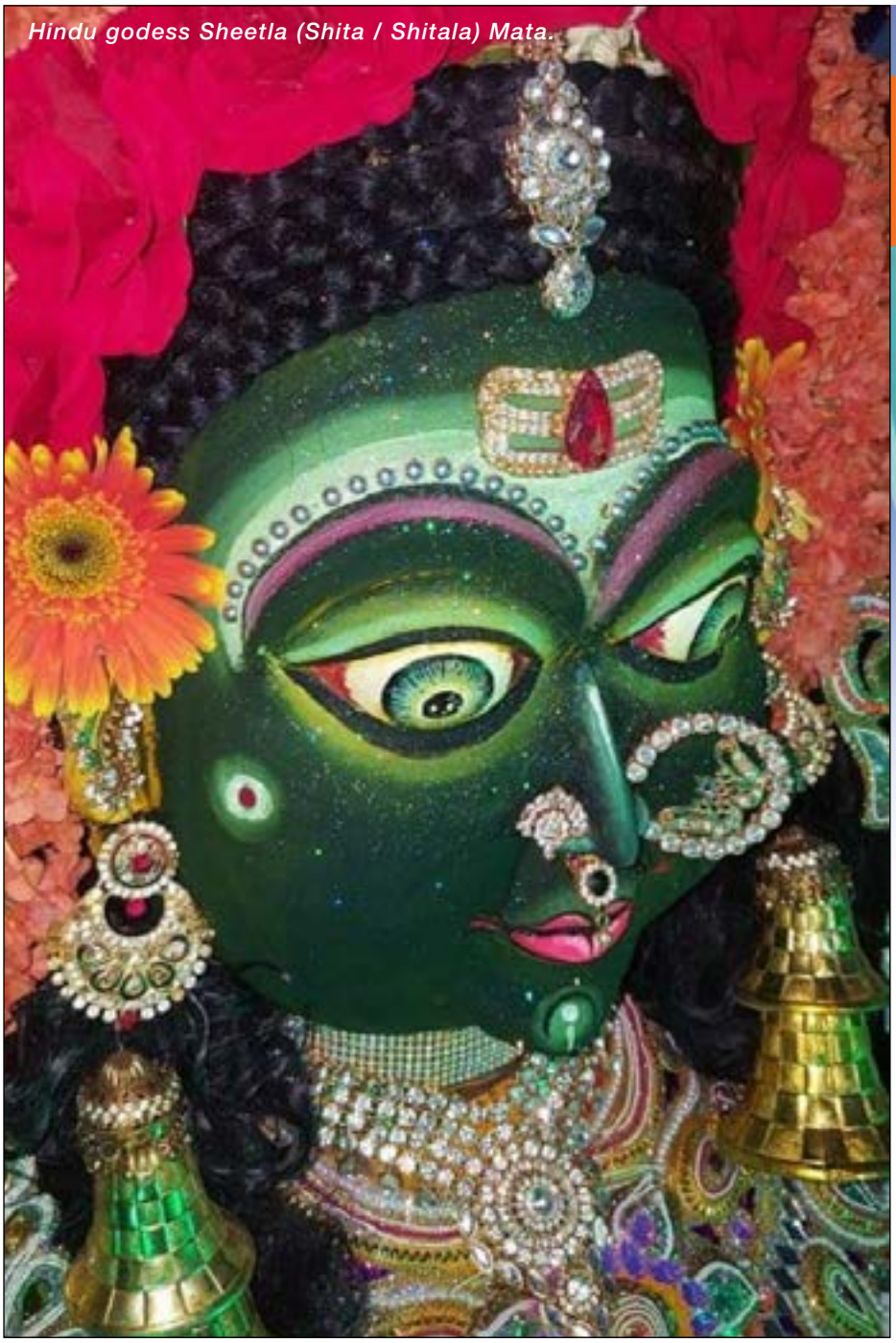

Hindu godess Sheetla (Shita / Shitala) Mata.

Ceremonial mask

Sheetla (Shita / Shitala) Mata is revered as the Hindu goddess of smallpox, and now of general ailments. She rides on a donkey, and carries with her a silver broom, a small bowl of water, and wears fan on her head. All of these are symbolic and used to rid a patient and their house of disease. The donkey is a beast of burden that remains calm under pressure, works tirelessly, and endures pain without ever giving up. It's a reminder to patients who are ill to never tire from fighting their disease, nor lose hope of being cured. These highly decorated and colourful masks are displayed during celebrations, religious ceremonies and even during displays of storytelling. Interestingly all the colours, textures and patterns that adorn these impressive masks all convey specific meanings and messages.

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Our Front Cover for this Issue...

The theme for the Front Cover of the South African Dental Journal this year showcases various types of masks. Masks have been admired and worn throughout the world for centuries and play an integral part of many activities including customary rituals, cultural events, battles, entertainment, and for protection. The cover for October features the Hindu goddess Sheetla (Shita / Shitala) Mata.

Ceremonial mask

Sheetla (Shita / Shitala) Mata is revered as the Hindu goddess of smallpox, and now of general ailments. She rides on a donkey, and carries with her a silver broom, a small bowl of water, and wears fan on her head. All of these are symbolic and used to rid a patient and their house of disease. The donkey is a beast of burden that remains calm under pressure, works tirelessly, and endures pain without ever giving up. It's a reminder to patients who are ill to never tire from fighting their disease, nor lose hope of being cured. Patients were also fed donkeys milk to cool their fever and assist in healing. The broom is used to clean the house from disease, while the fan is used to sift off unwanted particles from grain (thus to cleanse the food). The pot carries water from the Ganges, which is sprinkled over the house and the patient, once again purifying and cooling them respectively. These highly decorated and colourful masks are displayed during celebrations, religious ceremonies and even during displays of storytelling. Interestingly all the colours, textures and patterns that adorn these impressive masks all convey specific meanings and messages.

Courtesy of Dr Megna Gangadin and Prof Leanne Sykes

THE SOUTH AFRICAN DENTAL JOURNAL

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Call for emergency action to limit global temperature increases, restore biodiversity, and protect health

Wealthy nations must do much more, much faster

SADJ October 2021, Vol. 76 No. 9 p511 - p513

The UN General Assembly in September 2021 will bring countries together at a critical time for marshalling collective action to tackle the global environmental crisis. They will meet again at the biodiversity summit in Kunming, China, and the climate conference (COP26) in Glasgow, UK. Ahead of these pivotal meetings, we—the editors of health journals worldwide—call for urgent action to keep average global temperature increases below 1.5°C, halt the destruction of nature, and protect health.

Health is already being harmed by global temperature increases and the destruction of the natural world, a state of affairs health professionals have been bringing attention to for decades.[1] The science is unequivocal; a global increase of 1.5°C above the pre-industrial average and the continued loss of biodiversity risk catastrophic harm to health that will be impossible to reverse.[2,3] Despite the world's necessary preoccupation with covid-19, we cannot wait for the pandemic to pass to rapidly reduce emissions.

Reflecting the severity of the moment, this editorial appears in health journals across the world. We are united in recognising that only fundamental and equitable changes to societies will reverse our current trajectory. The risks to health of increases above 1.5°C are now well established.[2] Indeed, no temperature rise is "safe." In the past 20 years, heat related mortality among people aged over 65 has increased by more than 50%.[4] Higher temperatures have brought increased dehydration and renal function loss, dermatological malignancies, tropical infections, adverse mental health outcomes, pregnancy complications, allergies, and cardiovascular and pulmonary morbidity and mortality.[5,6] Harms disproportionately affect the most vulnerable, including children, older populations, ethnic minorities, poorer communities, and those with underlying health problems.[2,4]

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Global heating is also contributing to the decline in global yield potential for major crops, falling by 1.8-5.6% since 1981; this, together with the effects of extreme weather and soil depletion, is hampering efforts to reduce undernutrition.[4] Thriving ecosystems are essential to human health, and the widespread destruction of nature, including habitats and species, is eroding water and food security and increasing the chance of pandemics.[3,7,8]

The consequences of the environmental crisis fall disproportionately on those countries and communities that have contributed least to the problem and are least able to mitigate the harms. Yet no country, no matter how wealthy, can shield itself from these impacts. Allowing the consequences to fall disproportionately on the most vulnerable will breed more conflict, food insecurity, forced displacement, and zoonotic disease—with severe implications for all countries and communities. As with the covid-19 pandemic, we are globally as strong as our weakest member.

Rises above 1.5°C increase the chance of reaching tipping points in natural systems that could lock the world into an acutely unstable state. This would critically impair our ability to mitigate harms and to prevent catastrophic, runaway environmental change.[9,10]

Global targets are not enough

Encouragingly, many governments, financial institutions, and businesses are setting targets to reach net-zero emissions, including targets for 2030. The cost of renewable energy is dropping rapidly. Many countries are aiming to protect at least 30% of the world's land and oceans by 2030.[11]

These promises are not enough. Targets are easy to set and hard to achieve. They are yet to be matched with credible short- and longer-term plans to accelerate

cleaner technologies and transform societies. Emissions reduction plans do not adequately incorporate health considerations.12 Concern is growing that temperature rises above 1.5°C are beginning to be

seen as inevitable, or even acceptable, to powerful members of the global community.[13] Relatedly, current strategies for reducing emissions to net zero by the middle of the century implausibly assume that the world will acquire great capabilities to remove greenhouse gases from the atmosphere.[14,15]

This insufficient action means that temperature increases are likely to be well in excess of 2°C,[16] a catastrophic outcome for health and environmental stability. Crucially, the destruction of nature does not have parity of esteem with the climate element of the crisis, and every single global target to restore biodiversity loss by 2020 was missed.[17] This is an overall environmental crisis.[18]

Health professionals are united with environmental scientists, businesses, and many others in rejecting that this outcome is inevitable. More can and must be done now—in Glasgow and Kunming—and in the immediate years that follow. We join health professionals worldwide who have already supported calls for rapid action.[1,19]

Equity must be at the centre of the global response. Contributing a fair share to the global effort means that reduction commitments must account for the cumulative, historical contribution each country has made to emissions, as well as its current emissions and capacity to respond. Wealthier countries will have to cut emissions more quickly, making reductions by 2030 beyond those currently proposed[20,21] and reaching net-zero emissions before 2050. Similar targets and emergency action are needed for biodiversity loss and the wider destruction of the natural world.

To achieve these targets, governments must make fundamental changes to how our societies and economies are organised and how we live. The current strategy of encouraging markets to swap dirty for cleaner technologies is not enough. Governments must intervene to support the redesign of transport systems, cities, production and distribution of food, markets for financial investments, health systems, and much more. Global coordination is needed to ensure that the rush for cleaner technologies does not come at the cost of more environmental destruction and human exploitation.

Many governments met the threat of the covid-19 pandemic with unprecedented funding. The environmental crisis demands a similar emergency response. Huge investment will be needed, beyond what is being considered or delivered anywhere in the world. But such investments will produce huge positive health and economic outcomes. These include high quality jobs, reduced air pollution, increased physical activity, and improved housing and diet.

Better air quality alone would realise health benefits that easily offset the global costs of emissions reductions.[22] These measures will also improve the social and economic determinants of health, the poor state of which may have made populations more vulnerable to the covid-19 pandemic.[23] But the changes cannot be achieved through a return to damaging austerity policies or the continuation of the large inequalities of wealth and power within and between countries.

Cooperation hinges on wealthy nations doing more

In particular, countries that have disproportionately created the environmental crisis must do more to support low- and middle-income countries to build cleaner, healthier, and more resilient societies. High income countries must meet and go beyond their outstanding commitment to provide US$100 billion a year, making up for any shortfall in 2020 and increasing contributions to and beyond 2025. Funding must be equally split between mitigation and adaptation, including improving the resilience of health systems.

Financing should be through grants rather than loans, building local capabilities and truly empowering communities, and should come alongside forgiving large debts, which constrain the agency of so many low-income countries. Additional funding must be marshalled to compensate for inevitable loss and damage caused by the consequences of the environmental crisis.

As health professionals, we must do all we can to aid the transition to a sustainable, fairer, resilient, and healthier world. Alongside acting to reduce the harm from the environmental crisis, we should proactively contribute to global prevention of further damage and action on the root causes of the crisis. We must hold global leaders to account and continue to educate others about the health risks of the crisis. We must join in the work to achieve environmentally sustainable health systems before 2040, recognising that this will mean changing clinical practice. Health institutions have already divested more than US$42 billion of assets from fossil fuels; others should join them.[4] The greatest threat to global public health is the continued failure of world leaders to keep the global temperature rise below 1.5°C and to restore nature. Urgent, society-wide changes must be made and will lead to a fairer and healthier world. We, as editors of health journals, call for governments and other leaders to act, marking 2021 as the year that the world finally changes course.

Competing interests

All authors have completed the ICMJE conflict of interest form. FG serves on the executive committee for the UK Health Alliance on Climate Change and is a Trustee of the Eden Project. RS is the chair of Patients Know Best, has stock in UnitedHealth Group, has done consultancy work for Oxford Pharmagenesis, and is chair of the Lancet Commission of the Value of Death. The other authors declare no competing interests.

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Note: This editorial is being published simultaneously in many international journals. Please see the full list here: https://www.bmj.com/content/full-list-authors-and-signatories-climate-emergency-editorial-september-2021

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Meeting CPD requirements the correct way

SADJ October 2021, Vol. 76 No. 9 p514

Dr Nthabiseng Metsing, Head: Professional Development, SADA

As the year draws to an end (a very frantic year might I add), it is important for practitioners to wrap it up diligently. By this we would like to inspire all practitioners to ensure that they reach all the required continuous educational units. We all know that healthcare practitioners have a responsibility to continually update their professional knowledge and skills for the end benefit of the patients or clients. Over the past nearly two years, service providers have had to adapt to the virtual reality that the Covid -19 pandemic has compelled us into, this has meant that a lot of the CPD events in 2020/2021 have had be completed as webinars. This was in an effort to reduce the number of persons gathering at venues, in line with the Covid -19 regulations but also ensuring that healthcare workers still manage to meet their HPCSA obligation.

We cannot over emphasise the importance of compliance because mandatory random audits are conducted to ensure this compliancy. Once a practitioner's name has been selected, they are required to submit a CPD portfolio to Council within 21 days. Non-compliant practitioners will be given six months in order to comply. After the period of 6 months a practitioner will again be audited and if there is still non-compliance, the Professional Board will consider an appropriate action to take against the said practitioner.

While we encourage members to comply, we would also like to caution members about the importance of attending webinars that are offered by accredited service providers and to also attend webinars or events that fall within their scope of practice. Before we go any further let's clarify a few terms.

Accreditors are a group or institution appointed by a Professional Board to review and approve applications for the provision of CPD activities (within its profession's ambit) by organizations and individuals without accredited service provider status; to monitor these activities; and to revise continuing education units (CEUs) allocated where the provider failed to comply with the rules and regulations of the CPD guidelines. Professional Boards may delegate their responsibility for accrediting service providers to Accreditors with the mutual agreement of the Accreditor.

Accredited Service Providers are the profession specific higher education institutions and departments, professional associations or formally constituted professional interest groups who meet the specified criteria and have been accredited by the Board/ or its designated Accreditor to present learning activities for Continuing Professional Development.

HPCSA requirements per oral health practitioner.

Abbreviation	Register	Minimum number of CEU's	Ethics, Human Rights or Health Law
DP	Dentist	30	5
DA	Dental Assistant	15	2
OH	Oral Hygienist	30	5
TT	Dental Therapist	30	5

Service Providers

There are two broad categories of service providers: (1) Accredited Service Providers and (2) Service Providers. Both groups of Service providers offer CPD learning activities to health practitioners. While there are different criteria and application processes for each, there are similar roles and responsibilities.

Accredited Service Providers are any one of the following:

- Tertiary training institutions
- Professional associations
- Formally constituted professional interest groups that have a professional identity and
- are aligned with a training institution, a professional association or an international institution.

Service Providers are any one of the following:

- Organisations and associations as under accredited service provides, but who choose not to apply for accredited provider status
    - Individuals
    - Organizations/Institutions/Societies such as:
    - public and private hospitals;
    - private non-profit groups;
    - commercial enterprises or companies that support health professionals through products or services; schools;
    - non-government organisations

Accreditation period

The accreditation period for accredited service providers is valid for one year while for service providers it is valid for the period indicated by the accreditor. It is important for delegates/attendees to receive their certificates after attending a webinar/event. The certificate should contain:

- The accreditation and activity number (a board specific identification) (e.g., MDB001/12/09/2008)
- The topic of the activity (ethics, human rights and health law must be specified separately)
- The level of the activity
- The number of CEUs for that activity
- The attendance/completion date
- The name and HPCSA registration number of the attendee

While the HPCSA may require all practitioners to keep up with their continuous professional development, it is important for members to know that these CPD events do not equate to a professional qualification. Members are encouraged to obtain a formal qualification should they wish to focus on more specialised service delivery in the surgeries. A post graduate qualification may include anything from a diploma to a PHD and anything in between.

A Tale of Two Tusks

SADJ October 2021, Vol. 76 No. 9 p515

GH Sperber[1]

ABSTRACT

A record of the environment in which an Arctic Woolly Mammoth and a Narwhal existed is embedded in their dentitions. Variations in the landscapes and marine environments in which the animals lived is recorded in their post-mortem tusks. Odontographic evidence stored in teeth can provide an historic record of an animals' life experiences.

Key Words

Tusks; Mammoths; Narwhals.

Of all the categories of recorded evidence of life experiences, none exceeds that of the information buried within teeth. As the most durable of all tissues of once-living bodies, dentitions can provide post-mortem documentation of nutritional intake and metabolic disturbances during a past lifetime. Odontographic evidence stored in continually- growing tusks can provide an historic record of life experiences of an animal. By analyzing the biogeochemical markers in tusks, insights can be gained into the foraging ecology of an animal. Foods eaten not only impact the surfaces of teeth but also provide biochemical and biomechanical evidence of the characteristics of ingested foods. Rough diets score scratches and and pitting imprints on dental surfaces, allowing interpretation of the dietary environment. Acidic foods lead to enamel erosion.

The example of the neonatal line in the teeth of human infants demarcating the transition from breast feeding to masticatory nutritional intake provides odontological evidence of the altered nature of dietary intake.

Arctic Woolly Mammoth (Mammuthus primigenius) Tusk

The tracings of an extinct woolly mammoth's travels more than 17,000 years ago have been revealed in a study of the tusk of the extinct creature[1]. For the first time, scientists have translated the chemicals in an ancient tusk to reveal a prehistoric biography. The continuous eruption of the tusks throughout life provides an unprecedented insight into the environment in which the animal lived. Study of the isotopes of strontium deposited in the tusks of a woolly mammoth provided evidence of the geology of the environment through which the animal moved. The varying isotope data indicated four significant life stages: neonate, juvenile, adult and the last 1.5 years of life. During its life, scientists have translated the tusk's chemicals in the first two years of the animal's life.

Dental isotope data provided evidence of breast feeding during this time. The tip of the tusk revealed a young mammoth with minimal strontium variation. As a juvenile, (2-16 years) represented by the next 75 cms of tusk, strontium variation revealed a larger range of dietary intake. After the animal's teenage years, isotopic variations in the tusk revealed immense differences in dietary intake, reflecting its travels. After 16 years, a distinct transition of Strontium variation and other isotopic variations reflected a transition to sexual maturity and travels in response to seasonal changes and food availability. A distinctive isotope pattern recorded at the base of the tusk showed the telltale hallmark of starvation. At the base of the tusk, representing the last 1.5 years of its life, the mammoth's range was restricted, reflected in the tusk's composition that indicated starvation[2]. The strontium and nitrogen values in the root of the two-meter-long tusk established the age of death at a relatively early 28 years.

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Narwhal (Monodon monocerus) Tusk

As its Latin Zoological classification, "Monodon" implies, a single toothed whale describes the species. Narwhal tusks are predominantly confined to the males of the species and are usually unilateral, representing the left canine tooth. The tusk can reach a length of up to nine feet and exhibit a left-handed spiral pattern. The tusk lacks an enamel covering, being covered by cementum[3]. The main tissue component is dentine, providing the dentine composition with dentinal tubules and an extraordinary sensory ability[4]. As a continually growing tooth throughout life, narwhal tusks provide an unprecedented opportunity to analyze the marine environment in which narwhals exist. The biochemical evidence contained within their tusks provides an opportunity to analyze the lifelong feeding ecology and mercury exposure in the seas in which they live[5].

The continuous growth of a narwhal's tusk provides a time-lapse record of the environment in which it lived. Arctic climate change and mercury exposure are revealed in the rapidly warming and environmental contamination of the ocean. The reduced sea-ice and pollution of the seas are being revealed in the migrations of narwhals by identification of the changing biochemical constitution of their continually growing tusks. Recent chemical analyses of narwhal tusks reveal a steep increase in tusk mercury accumulation[6].

Summary

The role of teeth in recording dietary changes and environmental climate variation is identified in two species- one land based (mammoth) and the other marine based (narwhal). The post-mortem permanence of their dentitions provides insights into the feeding ecology and past eras in which the animals lived.

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http://dx.doi.org/10.17159/2519-0105/2021/v76no9a1

Effect of flask closure method on occlusal vertical dimension of complete upper and lower dentures

SADJ October 2021, Vol. 76 No. 9 p517 - p523

LG Maguga[1], SR Mthethwa[2]

ABSTRACT

Introduction
The movement of teeth during processing of complete dentures disturbs the harmonious occlusal scheme established at the final wax try-in stage.

Aims and objectives
To investigate the effect of RS flask closure on occlusal vertical dimensions of complete dentures. The mean occlusal vertical dimension of complete maxillary and mandibular dentures fabricated by the conventional flask closure were measured and compared with that of dentures fabricated by RS flask closure.

Design
A pretest-posttest control group experimental design.

Methods
Thirty sets of complete maxillary and mandibular wax trial dentures were randomly assigned to experimental groups. Fifteen sets were assigned to conventional flask closure and the remainder to RS flask closure. Compression molding with a long curing cycle was performed for the processing of the dentures. Pre-processing and post-processing occlusal vertical dimensions were determined.

Results
The mean occlusal vertical dimensions of wax trial dentures assigned to either group were similar. The data produced substantial evidence to reject the null hypothesis that the post-processing mean occlusal vertical dimensions of both groups were equal.

Conclusion
The occlusal vertical dimensions produced by dentures clamped by the RS flask closure were significantly less than those produced by dentures clamped by the conventional flask closure.

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2. **Sibusiso R Mthethwa:** – analysis and interpretation of data; drafting the article

INTRODUCTION AND BACKGROUND

Tooth movement during the laboratory processing of complete dentures is well researched. A recent systematic review combined information from 114 published studies found in PubMed on the factors and variables involved in complete denture processing that can contribute to tooth displacement and the precautions required to minimize it. The review concluded that there are two main factors responsible for occlusal discrepancies in the processed dentures: change in the relationship of a tooth / teeth to the master cast during processing as a result of investing procedure, careless packing of acrylic resins in the mould cavity, or improper flask closure and warpage of the denture base due to release of inherent strains when the denture is separated from the cast.[1]

Vertical tooth movements which occur during denture processing may alter the occlusal vertical dimension, which the Glossary of Prosthodontic Terms (2017) defined as the distance between two selected anatomic or marked points (usually one on the tip of the nose and the other on the chin) when in maximal intercuspal position.[2] Clinical studies have shown increased (excessive) occlusal vertical dimension (OVD) to be a common fault of many dentures.[3] The direct consequence of an increased OVD is a reduction of the freeway space, which is defined as the distance between the occluding surfaces of the maxillary and mandibular teeth when the mandible is in a specified position.[2] Freeway space is also referred to as interocclusal rest distance or space.[2] The incorrect measurement of OVD and resultant provision of insufficient freeway space has been found to lead to teeth clashing; difficulties approximating the lips; discomfort brought about constant stimulation of the muscles; poor appearance; cheek biting; angular chelitis; temporomandibular joint pain; Costen's syndrome and masticatory inefficiency.[4]

To recover the proper vertical dimension of occlusion, a time-consuming occlusal adjustment is necessary that often destroys the anatomy of the artificial teeth.[5] Various studies have been conducted to identify improved materials and processing techniques to minimize changes

in the occlusion.[6] The effect of flask closure method has been studied. Denture bases fabricated by the Rafael & Saide (RS) flask closure method using the long curing cycle were found to be more dimensionally stable.[7,8] The reduction in base inaccuracies allowed the teeth to preserve their position in the dentures.[9,10]

The RS flask closure method was proposed as an alternative to conventional flask closure method. In the conventional flask closure method, pressure is released when the flask is removed from the manual or hydraulic press and placed in the spring clamp. In contrast, in the RS flask closure method, the flask halves remain in contact when the flask is removed from the hydraulic press thus maintaining the acrylic resin under constant pressure conditions.[7]

The effect of the RS flask closure on linear displacement of maxillary denture teeth is not well defined. Conflicting results have been reported. Whereas, the results of a study by Negreiros, Consani, Mesquita, Sinhoreti and Faria (2009)[11] found that in the immediate post-pressing time, the tooth movement was significantly greater for the conventional flask closure method and no statistically significant difference was observed between the post-pressing times in all distances evaluated in dentures obtained by the RS flask closure method, Consani, Domitti, Mesquita and Consani (2006)[12] and Negreiros, Consani and Mesquita (2008)[13] reported that tooth movement was similar in dentures processed by traditional closure and by RS flask closure. All three studies examined the displacement of maxillary denture teeth.

Aims

To test the hypothesis that the occlusal vertical dimensions produced in complete maxillary and mandibular dentures clamped by the RS flask closure method were significantly less than those produced by dentures clamped by the conventional method.

OBJECTIVE OF THE STUDY

To measure and compare the mean occlusal vertical dimension of complete maxillary and mandibular dentures fabricated by the conventional method with that of dentures fabricated by the RS flask closure technique using the long curing cycles.

MATERIALS AND METHODS

Design

This was a pretest-posttest control group experimental design.

Target population

The study population consisted of thirty sets of simulated removable complete maxillary and mandibular dentures.

Sample size

Twenty-eight sets of simulated complete maxillary and mandibular dentures were eligible to participate in the study. Two sets of dentures were excluded from the study due to distortion in processing resulting from contraction and gaseous porosity.

Allocation method

A sequence of random numbers was generated by a statistician using the computer software program SPSS (IBM, 2018).[14] The allocation sequence was concealed in a desktop computer until interventions were assigned by the supervisor (second author). The random allocation rule was implemented i.e. a subset of the total sample size was randomly assigned by the research supervisor to group A (conventional flask closure method) and the remainder were assigned to group B (RS flask closure method).

Blinding

The researcher fabricated wax trial dentures, which were assigned sequential numbers from 1 to 30. Fifteen sets of wax trial dentures were randomly assigned by the research supervisor to group A (conventional flask closure method) and the remainder were assigned to group B (RS flask closure method). The researcher (first author) was blinded to group assignment. Pre-processing and post-processing occlusal vertical dimensions were determined by the researcher in the presence of the supervisor. The dentures were processed according to group assignment.

Interventions

The standard methods of fabricating dentures described by Sowter (1986)[15] and Johnson, Patrick, Strokes, Wildgoose and Wood (2016)[16] were used to fabricate thirty sets of complete maxillary and mandibular wax trial dentures on type 3 dental stone casts of a prefabricated silicone mould on one semi-adjustable articulator locked only to allow a hinge movement and maintained the same vertical dimension. The prefabricated silicone mould is routinely used to prepare maxillary and mandibular stone casts for students. The wax trial dentures were randomly assigned to experimental groups and invested in flasks following the method described by Mosharraf, Iranmanesh and Sadeghi (2007).[17] A single operator i.e. the researcher, carried out all the laboratory steps and procedures using a single articulator for all the set ups. The laboratory steps and procedures followed in fabricating complete dentures allocated to RS flask closure and the conventional flask closure were identical. The only difference in processing between the finished complete acrylic dentures were the methods used to close the flasks.

In the conventional flask closure, the acrylic resin dough was placed into the large half of the flask where the teeth were and pressed down firmly into the mould. The two halves of the flasks were closed in a hydraulic press until

Figure 1: Conventional flask closure method

Figure 2: RS flask closure method

the flasks were closed. Flasks were removed from the hydraulic press and transferred to traditional spring clamps.

In the RS flask closure, the acrylic resin dough was placed into the large half of the flask where the teeth were and pressed down firmly into the mould. The two halves of the flasks were closed and positioned between the 2 plates of the RS closure system and placed under pressure using a hydraulic press. The screws of the lower plate were fitted into the holes of the upper plate. After hydraulic flask pressure, the screw nuts were strongly tightened to the screws before press releasing.

Following flask closure, all denture sets were cured in a water bath. The temperature of the water curing bath was set to rise from 24°C-74°C in an hour and then maintain the temperature for 8 hours (long curing cycle). The processed dentures were allowed to cool down inside their curing water.

Figure 3: below is a flow diagram of the progress through the phases of the study (that is, enrolment, treatment allocation, follow-up, and data analysis).

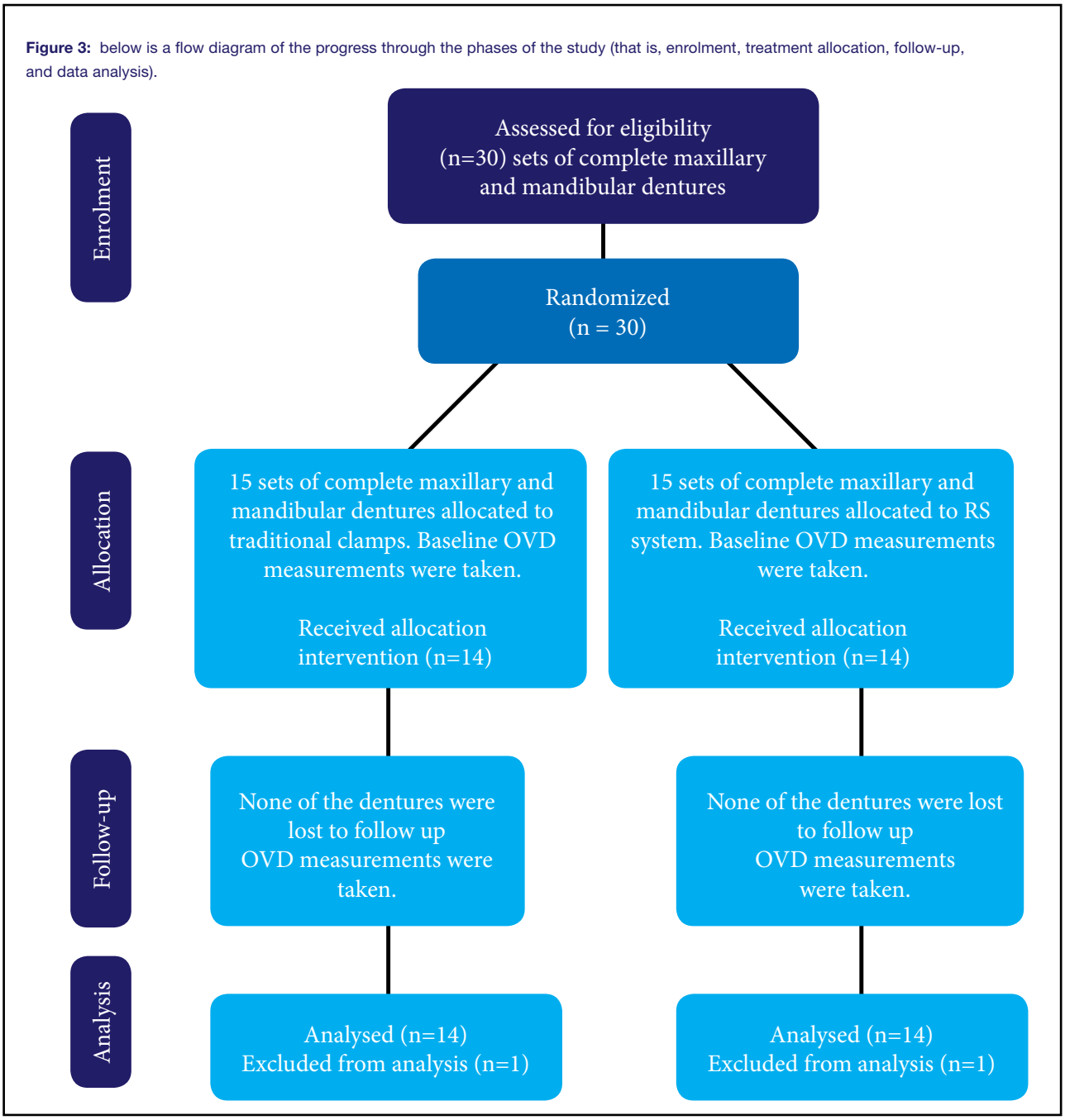


Table 1: Occlusal vertical dimensions at baseline

Treatment	Sample size	Mean OVD (mm)	Standard Deviation
Group A wax trial dentures	14	134.548	.03262
Group B wax trial dentures	14	134.539	.02731
Both groups	28	134.544	.02984

A= conventional flask closure; B = RS flask closure

The similarity in mean occlusal vertical dimensions indicate that the measurements were evenly distributed in the treatment groups. The mean occlusal vertical dimensions of both groups was 134.544 mm.

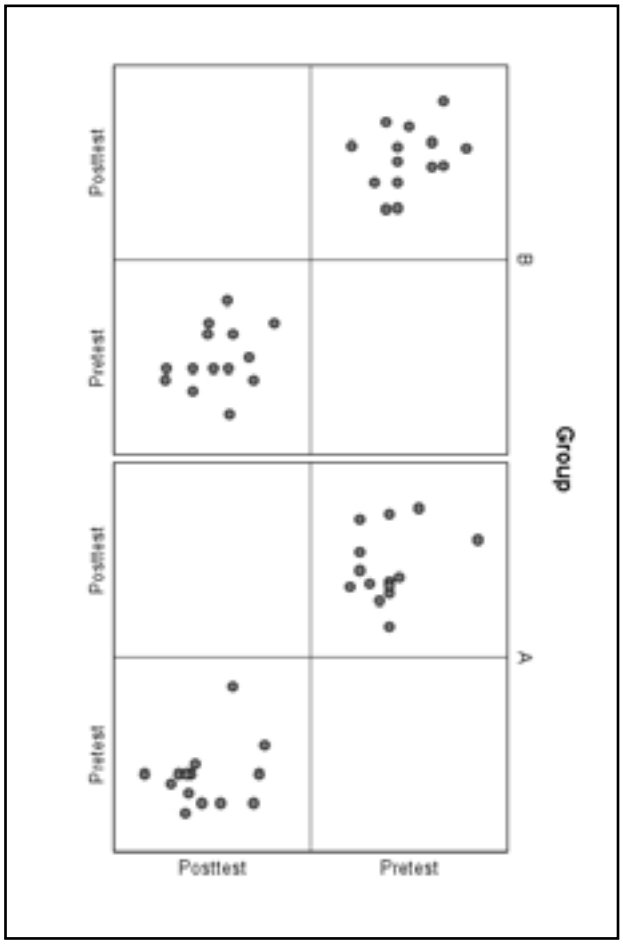
Table 2: Test of Normality

Groups	Shapiro-Wilk		
	Statistic	df	Sig.
A	.931	14	.313
B	.970	14	.875

A= conventional flask closure; B = RS flask closure

There was insufficient evidence to reject the null hypothesis that the dependent variable data was normally distributed by each level of the independent variable (p (0.931 and .970 respectively were > 0.05). The assumption of normality homogeneity of variance was met.

Figure 4: Linear relationship between dependent and covariate by each level of the independent variable



A = Conventional flask closure; B = RS flask closure
The left side of the scatter-plot matrix was interpreted. The points did not have an elliptical shape starting from the bottom left to the top right in the plot of pretest and posttest for group B (posttest is on X axis and the pretest is on the Y axis). The assumption of a linear relationship between dependent and covariate by each level of the independent variable was violated.

Primary outcome

The primary outcome was the mean occlusal vertical dimensions of each group. The occlusal vertical dimension was determined between reference lines marked on the maxillary and mandibular jaw members of the articulator, which was positioned on a table, using a digital Vernier caliper capable of registering changes as small as 0.01mm. The marks were maintained throughout 30 set ups and remounts. The effect of interest was the difference in mean OVD between pre-processing and post-processing measurements. The reliability of the OVD measurements was assessed by performing repeat measurements for a random sample 20% of the wax trial and acrylic dentures.

Ethical considerations

The study protocol was approved and permission to conduct the study was granted by the Faculty of Science Committee for Postgraduate Studies of the Tshwane University of Technology.

STATISTICAL ANALYSIS/HYPOTHESIS TESTING

Collected data were subjected to univariate analysis in Statistical Package for the Social Sciences (SPSS) software. Measures of central tendency and dispersion were calculated. ANCOVA was performed to evaluate whether the means of

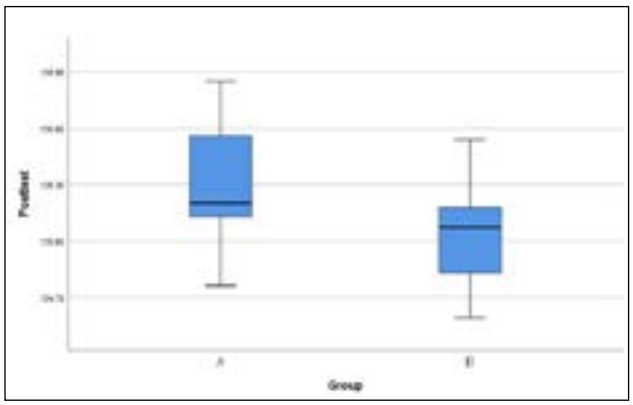


Figure 5: Outliers

Table 3: Independence of the covariate and treatment effect

Source	Sum of squares	DF	Mean Square	F Value	Sig
Corrected Model	.001a	1	.001	.568	.458
Intercept	506855.233	1	506855.233	560095036.	.000
				033	
Group	.001	1	.001	.568	.458
Error	.024	26	.001		
Total	506855.257	28			
Corrected Total	.024	27			

a. R Squared = .021 (Adjusted R Squared = -.016)

There was insufficient evidence (p (0.568) >0.05) to reject the null hypothesis that the covariate (pretest) was not different across the levels of the independent variable (treatment group) in the analysis.

Table 4: Homogeneity of regression slopes (Dependent variable: Posttest)

Source	Sum of squares	DF	Mean Square	F Value	Sig	Partial Eta Squared
Corrected	.666a	3	.222	2.440	.089	.234
Model						
Intercept	.065	1	.065	.709	.408	.029
Group *	.001	1	.001	.009	.927	.000
Pretest						
Group	.001	1	.001	.009	.927	.000
Pretest	.165	1	.165	1.809	.191	.070
Error	2.184	24	.091			
Total	511642.928	28				
Corrected	2.850	27				
Total						

a. R Squared = .234 (Adjusted R Squared = .138)

The interaction effect between the covariate (pretest) and independent variable (group) in a model that includes the interaction between the covariate and independent variable was not significant (p (0.927) >0.05). This means that the regression slopes for the independent variable (group) and covariate (pretest) are similar. The assumption of homogeneity of regression slopes was met.

the dependent variable i.e. post-processing mean occlusal vertical dimension were equal across levels of a categorical independent variable i.e. the group (conventional flask closure method = control, RS flask closure method = test), while statistically controlling for the effects of the covariate i.e. pre-processing mean occlusal vertical dimension. The level of significance was set at 0.05. Regression diagnostics was performed to evaluate the appropriateness of ANCOVA model. Six assumptions were checked to make sure that the covariate meets the requirements to run the ANCOVA. These were:

1. The dependent variable is normally distributed by each level of the independent variable
2. Outliers
3. Independence of the covariate and treatment effect
4. Linear relationship between dependent and covariate by each level of the independent variable
5. Homogeneity of regression slopes
6. Homogeneity of variance

RESULTS

Occlusal vertical dimensions (OVDs) of twenty-eight sets of complete maxillary and mandibular simulated dentures were analyzed. Figure 1 is a flow diagram of the progress through the phases of the study (that is, enrolment, treatment allocation, follow-up, and data analysis).

Table 5: Levene's test of equality of variances

F Value	DF1	DF2	Sig
.243	1	26	.626

There was insufficient evidence (p (0.626) >0.05) to reject the null hypothesis that the dependent variable variance was equal across groups. The assumption of homogeneity of variance was met.

DISCUSSION

This study was designed to determine the effect of RS flask closure method on the occlusal vertical dimensions of simulated dentures. The results indicate that the mean occlusal vertical dimension of trial wax dentures was 134.544 mm. (Table 1). Differences in summary measures used to analyze results together with differences in the reporting of results made it difficult to compare the results of the current study with that of previous studies. The current study used occlusal vertical dimension measurements obtained between reference lines on the maxillary and mandibular jaw members of the articulator, which was positioned on a table whereas a number of previous studies used the average incisal pin opening to analyze their results.[17-19] Several studies which obtained measurements in a comparable manner reported difference measures between pre-processing and post-processing measurements instead of the actual measurements.[20-22]

Table 6: ANCOVA (Dependent variable: Posttest)

Source	Type III Sum of squares	DF	Mean Square	F Value	Sig	Partial Eta Squared
Corrected Model	.665a	2	.333	3.807	.036	.233
Intercept	.064	1	.064	.733	.400	.028
Pretest	.166	1	.166	1.897	.181	.071
Group	.409	1	.409	4.682	.040	.158
Error	2.184	25	.087			
Total	511642.928	28				
Corrected Total	2.850	27				

a. R Squared = .233 (Adjusted R Squared = .172)

There was a statistically significant difference (p (0.04) <0.05) in the dependent variable mean OVD across levels of the group when controlling for the covariate (pretest).

Table 7: Marginal means (Dependent variable: Posttest)

Groups	Mean	Std. Error	Lower Bound	Upper Bound
A	135.299a	.079	135.136	135.463
B	135.055a	.079	134.891	135.219

a. Covariates appearing in the model are evaluated at the following values: Pretest = 134,5436.

A statistically significant (p (0.04) <0.05) in Table 6 above.) drop in mean OVD from 135.299 in group A to 135.055 in group B was estimated when controlling for the covariate (pretest).

Table 8: Independent-samples t-test comparison of posttest descriptive means

							95.0% Confidence	
Groups	Mean	Std.	t	Deviation	df	Sig. (2-tailed)	Mean Difference	Intervals for Difference
							Lower Limit	Upper Limit
A	135.3107	.325	2.350	26.000	.027	.267	.044	.490
B	135.043	.274						

A= conventional flask closure; B = RS flask closure

The 95% confidence interval of the difference in mean OVD between the groups ranged from .044 to .490.

The results of this study showed an even distribution of occlusal vertical dimensions at baseline between the groups (Table 1). These findings suggest that the randomization procedure achieved the goal of minimizing allocation bias. The results of the regression diagnostics showed that the data satisfied five of six underlying assumptions inherent in the ANCOVA model (Tables 2, 3, 4, and 5 and Figure 2). They confirmed that the ANCOVA model was the appropriate analysis for this study - consequently, the validity of the conclusions drawn could be relied upon.

This experiment found substantial evidence (p (0.04) <0.05) to reject the null hypothesis that the posttest occlusal vertical dimensions were equal across levels of the group when controlling for the covariate (pretest) i.e. the difference in occlusal vertical dimensions between simulated dentures which were fabricated using RS flask closure method and those which were fabricated using the conventional flask closure method was statistically significant (Tables 6 and 8). This result has not previously been described. However, the findings of the current study support those of Negreiros and colleagues who found that in the immediate post-pressing time, the tooth movement was significantly greater for the conventional flask closure method compared with the RS flask closure method.[11] More research needs to be undertaken before the relationship between occlusal vertical dimension and the RS flask closure method is more clearly understood.

The most interesting finding was that the lower limit of the 95% confidence interval for the mean difference between simulated dentures fabricated using the RS flask closure method and those which were fabricated using the conventional flask closure method was very close to zero (Table 8). This indicates that the true difference may be very small and clinically meaningless despite the statistically significant result (p (0.027) < 0.05).

Another important finding was that the 95% confidence interval for the mean difference between simulated dentures fabricated using the RS flask closure method and those which were fabricated using the conventional flask closure method was wide (Table 8). A wide confidence interval however indicates that the estimate of the mean difference was not precise. A wide confidence interval results from a small sample and /or data with substantial variability, and is a suggestion of low power.[23]

Limitations of the study

A potential threat to the internal validity of this study was the large number of tests of statistical significance which were carried out. This increases the type 1 error rate, which leads to risk for spurious relationships and thus the conclusions that can be reached.

The small sample size gave rise to the wide confidence interval of the effect of interest

CONCLUSION

The mean occlusal vertical dimensions produced by dentures clamped by RS flask closure was significantly less than that produced by dentures clamped by the conventional flask closure.

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Should dental amalgams be used in dental training? The perspectives of dental academics at a university in South Africa

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ABSTRACT

Introduction

Dental amalgam has been used in dentistry for the last 150 years to restore posterior teeth. Concerns regarding the safety issues with amalgam due to its mercury content have lead to the introduction of composite dental material to restore posterior teeth. This has transformed the teaching and training trends of direct restorative materials for posterior teeth.

Objectives

This descriptive study aimed to gain insight into academic staff and clinical supervisors' perceptions regarding the use of dental amalgams in the teaching of restorative dentistry.

Methods

This study used a qualitative method of data collection. Two focus group discussions were conducted between March and May 2020.

Results

Seventeen participants were invited to participate. Fourteen responded and participated, yielding an 82% response rate. The data identified two major themes, viz. the challenges experienced with the teaching of dental amalgam and curriculum development recommendations. Clinical quota requirements, disposal of waste products, and occupational and environmental risks regarding mercury exposure were sub-themes. Some of the curriculum recommendations included the skills gained during cavity preparations, the training and quota requirements of dental materials, and teaching trends locally, nationally and internationally.

Conclusion

This study revealed that dental amalgam is still an integral part of the restorative dentistry curriculum at the university. However, the teaching of resin composite now occupies more than fifty percent of the restorative dentistry curriculum. Academics and clinical supervisors show a greater affinity for the placement of composite restorations.

Keywords

dental amalgam; composite resin; dental curriculum; dental education; restorative dentistry, dental materials

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2. **Dr Rajeshree Moodley:** was responsible for research supervision, study design and manuscript review.

INTRODUCTION

Dental caries, commonly known as tooth decay or dental cavities, are considered one of the most common non-communicable diseases worldwide.[1] Caries results in the early stages of enamel breakdown, spreading into the dentin layer and causing tooth sensitivity and pain. At this stage, a tooth has to be restored by a dental professional.[2] The direct restorative material commonly used is either dental amalgam or resin composite.[3] Dental amalgam has been used in dentistry to restore posterior teeth for the last 150 years. Concerns regarding the safety issues with dental amalgam and its mercury content, have resulted in the introduction of resin composite material to restore posterior teeth.[4] Resin-based composites have been used to restore teeth for approximately 60 years.[5] The move towards resin-based composite material in dentistry has transformed the teaching and training of direct restoration materials.[6] There have been variations in the teaching with dental amalgam globally, with some countries completely stopping, while other countries are still teaching students with it.[7]

Undergraduates placed in the United Kingdom dental schools have gained more experience in composite restorations than dental amalgam.[8] Moreover, dental amalgam is no longer used in paediatric dentistry.[8] Other studies conducted by Lynch and Wilson (2013) found that posterior composites' teaching is also well established in Ireland, Brazil, USA, Japan, Canada, and Spain. It was established that students in the UK are more adept with composite restorations, emphasising the minimally

Table 1: Demographic details of participants (n=14)				
		Focus group 1 (n=6)	Focus group 2 (n=8)	Total (n=14)
Gender	Males	3	2	5
	Females	3	6	9
Work experience (years)	<5	1	0	1
	5 – 10	1	1	2
	11 – 19	1	1	2
	20 - 29	3	6	9
Educational Qualification	Undergraduate	6	2	8
	Postgraduate			
	Masters	0	2	2
	PhD	0	4	4
Clinical Position	Dentist	4	1	5
	Dental therapist	2	2	4
	Oral hygienist (dual qualified as a hygienist and dental therapist)	0	1	1
	Lecturer	0	5	5
	Private practice	0	3	3
Place of work	Department of Health	6	0	6
	University	0	5	5
Dental supervision (years)	<5	2	0	2
	5 – 10	4	2	6
	11 – 15	0	6	6
Involvement in dental curriculum planning	Yes	1	4	5
	No	5	4	9

interventive technique of dentistry.[7] Health authorities in the European Union have worked together with dental schools to reduce amalgam usage. Dental schools in the Netherlands stopped teaching restorative techniques with amalgam between 1995 and 2005. In the early 2000s, Sweden emphasised teaching resin composites with minimal time spent on the theory component of dental amalgam.[9] Schools in Denmark actively encourage the placement of composite restorations, while in Japan, 93% of dental schools emphasise the teaching of mercury-free restorations. Sweden, Germany and Norway have completely restricted dental amalgam due to environmental issues.[9]

A study in Saudi Arabia found that students in both the government and private dental schools felt more confident with the placement of composite restorations than amalgam. However, both schools felt that amalgam should not be replaced entirely by composite.[10] Participants in an Australian study strongly agreed that 80% of teaching should be conducted using composite restorations and not amalgam.[11] A study conducted among dental schools in North America revealed that 97% of dental schools still conduct teaching with dental amalgam. However, most of them revealed that the teaching time allocated to amalgam is approximately 30%.[12] It was found that the teaching of dental amalgam is still widely emphasised in Nigeria. Students were more likely to place amalgam (60%) restorations than resin composite.[13] However, one dental school in Nigeria is determined to move towards mercury-free dental materials. It has already stopped placing amalgam restorations in children's teeth.[13]

This descriptive study aimed to determine dental academic perceptions regarding the teaching of amalgam in a dental school in South Africa. This was the first time a study of this type regarding dental therapists' training was carried out. The scope of training of dental therapists in South Africa includes examining a patient, restoration of primary and permanent teeth, scaling and polishing, taking dental radiographs, administering local anaesthesia, health education and promotion, and diagnosing common oral diseases. In addition, a targeted review of the curriculum was also conducted.

METHODS

Research setting and context

The study was located within a dental school in South Africa. Two programs are offered at this institution: B. Dental Therapy and B. Oral Hygiene. The study was conducted between March and May 2020. Ethical approval was granted from the Social Sciences and Humanities Ethics Committee of the University of KwaZulu-Natal (HSSREC/00000622/2019) and gatekeeper permission from the clinical training head and the registrar.

Research design

This descriptive study used a qualitative method for data collection. It was conducted to gain insights into dental amalgam usage in dental training.

Participants

All academic and clinical staff involved in the teaching and supervision of restorative dentistry were invited (n=17). A purposive sampling method was used to identify participants. The participants included dentists and dental therapists. All participants agreed to participate in the study as well as to an audio recording of the discussions. In addition, a targeted review of the curriculum was conducted using a self developed checklist.

Table 2. Challenges faced with the teaching and training with amalgam

Sub-theme	Description	Participants Response
1.Increase in student intake at the university	Student numbers have increased to cope with the increased health demands for dental therapists	Focus group 2, P7: 'The numbers have increased in the class, puts a lot of pressure on the full-time staff or whatever staff…too many of them (students)and I think that it is a problem.' Focus group , Pii: 'The trend has changed not only because it is driven by the curriculum but also driven by the student numbers. And it is also driven by the amount of time that you have to train the students, the time has been greatly reduced, the student numbers have increased drastically, So the cut down in time has obviously impacted on that. so previously, there has always been enough time allocated for that.'
2.Clinical quota requirements for composite and amalgam restorations	Students must complete composite restorations and amalgam restorations in the clinic	Focus group 1, Piv: 'so I think it's almost unfair to say for the sake of the quota that you must have this (amalgam). Because at the end of the day, let the patient decide what they want.' Focus group 2, P8: 'because it's a teaching institution, students have to do a certain amount of amalgams per year. They have to complete their quotas…' Focus group 2, P6: 'If you look at previous years, most students do not complete the amalgam quota. Towards the end (of the year), you find that most students are scrambling to find patients. You find that a tooth that should not be an amalgam restoration becomes an amalgam restoration in the end.' Focus group 1, P ii: 'Some of the students are wanting to do a specific type of filling because they need that particular quota, and obviously, we wouldn't advocate for them to do that just because they need the quota. But there are instances where that is the reality.'
3.What guides the students' choice of dental material?	What factors in the clinic lead to the decision of what dental material is used?	Focus group 2, P6: 'It's easier to place a composite than to place an amalgam. With a composite, you place the material, put the light, and that's it. With an amalgam, you have to cut the cavity, run to the amalgamator, mix, come back, plug. It's a cumbersome process. But also I think that they prefer composite because it's less technique sensitive, unlike with amalgam you have to have sound walls, the floor (of the cavity) must be correct, you must have the correct angles and so on. It's easier to place a composite because you just follow the cavity. So I think that pushes our students a lot to use composite rather than amalgam.' Focus group 1, Piii: 'For amalgam, the preclinical training is a little more intense than for composites. Cavity preparation has to be done in a specific way. So the cut down in time has obviously impacted on that. So previously, there has always been enough time allocated for that. So I think that the trend is moving more towards composites.' Focus group 1, Pv: 'I'll say the number one would be the difficulty of the cavity prep and the difficulty of placing an amalgam. Even packing it is difficult, composite is so much easier, so they are going to choose the easier route.'
4.Correct disposal of amalgam waste products	How is amalgam waste disposed of during clinical training?	Focus group 2, P6: 'amalgam disposal is a problem.' Focus group 1, P6: 'the university does not have the correct waste disposal facilities.'
5. Patient preference	Patients are becoming increasingly aware dentistry and are making informed choices	Focus group 2, P7: '… even the poorest of patients doesn't want a 'black filling in their mouth.' Focus group 1, Pv: 'Our patients didn't really want it, they would ask for tooth coloured, but because of quota, we had to place amalgams.' Focus group 2, P8: 'dentistry is going towards aesthetics now, and they need to be good at it.'
6.Occupational and environmental risks using dental amalgam	The clinicians and staff were aware of the risks associated with the mercury content in amalgam	Focus group2, P7: 'They should phase it out…also because of the mercury content.' Focus group 2, P8: 'But I have also had patients in my practice that came in to remove and replace with composite because they have had medical issues with amalgam that was diagnosed by a specialist.' Focus group 2, P6: 'it's poisonous to practitioners.'

Data Collection and analysis

Two focus group discussions were conducted. Group one consisted of the clinical supervisors involved in restorative dentistry supervision at the clinical training site. The second group consisted of all academic staff, including the academic leader from the discipline. Two interviews were conducted as these staff were unable to join the focus group discussion, and the data obtained was merged with the academic group discussion. The two focus group discussions took place between March and May 2020. The researcher invited participants via email. An information sheet was given to all participants before the discussion outlining the reason for the study. A demographic sheet was sent before the meeting requesting demographic details. Participants were informed that they could withdraw from the study at any stage.

The first author collected data during both the focus group discussions. Focus group one was conducted face-to-face before the global pandemic. The second focus group was conducted virtually via Zoom. The areas explored included involvement in restorative teaching and training curriculum, guidelines for amalgam training and the future of amalgam in dental training. The interviews and focus group discussions

were conducted in English, and audio was recorded. The researcher transcribed the discussions verbatim, and thereafter the data was cleaned before analysis.

The thematic analysis followed the six-phase thematic analysis by Braun and Clarke (2006).[14] The researcher read through the transcripts several times to identify familiar patterns. Open coding was done manually by writing notes on the transcripts. Several codes were linked together to form overarching themes and sub-themes. A data verification process was conducted. The analysed data were sent to one participant from each focus group to analyse the interpreted data and provide feedback. Participants were assured of anonymity, as no names were used. Participants were given a participant ID. Focus group 1 - Participant i -vi, Focus group 2 - Participant 1-8.

A list of questions that analysed the restorative dentistry curriculum was emailed to the academic head. These questions assessed the teaching and preclinical training time that was taken for amalgam and composite resin materials. The researcher looked at the preclinical and clinical logbooks, the module templates and guidelines, and the yearbook.

RESULTS

The results are presented in three parts: demographics of participants, thematic analysis of the participants' responses, and a targeted review of the restorative dentistry curriculum. Seventeen participants were invited to participate; fourteen responded and participated, yielding an 82% response rate.

The demographic details are summarised in Table1. The average age group of participants in group 1 was 41years, and group 2 was 47,5 years. Seventy-nine percent (n=11) of participants have more than twenty years of experience in their respective professions. Forty-three percent (n=6) of the total participants have postgraduate degrees, with Masters (n=2) and (n=4) with a PhD. Sixty-four percent (n=9) were females. Forty-three percent (n=6) of participants had some involvement in the planning of the dental curriculum. Seventy-five percent of the participants had more than ten years of experience in restorative dentistry supervision.

Focus group

The participants' responses were broadly divided into themes, viz. the challenges faced with dental amalgam training (Table 2) and curriculum development recommendations (Table 3). The themes were further broken down into sub-themes. Some of those sub-themes identified with dental amalgam training challenges include increased student intake, clinical quota requirements, disposal of waste products, and occupational and environmental risks regarding mercury exposure.

The recommendations for training with dental amalgam included factors such as the implications of the Minamata convention, the continuing professional development of the participants, the skills gained during cavity preparations, guidelines to guide the training and quota requirements of dental materials, the awareness of the teaching trends locally, nationally and internationally. The responses are tabulated in Table 3.

Targeted review of the dental curriculum

A checklist and a list of questions was emailed to the academic leader. This revealed that second-year students were involved in preclinical training only on the dental laboratory's phantom head, while third-year students were exposed to preclinical training and clinical training at the dental training hospital. The third-year students were also involved in dental outreach programmes.

It was revealed that there are a total of 48 lectures, ten tutorials and 52 practical sessions. Whilst the handbook provides for 52 practical sessions, students do not have sufficient time. The leader reported that this is spread to observation, assisting and actual clinical work for the third years. Twelve phantom heads are available in the dental laboratory, and therefore 12 students can work at a time. The academic leader further reported that 'with more students' intake, there is less time for clinical training.' The third-year students go out on outreach programmes once a week, and students are exposed to both amalgam and composite training. The second-year preclinical training quotas require the student to perform 13 composite restorations, including all class types. Eleven amalgam restorations are required, which include all class types (except for anterior restorations). The minimum quota for the third year clinical training requires the student to perform 87 restorations, of which five must be bonded amalgam restorations of the different classes, 70 composite restorations (different classes), and ten temporary dressings and caries control restorations. The curriculum revealed that the placement of amalgam restorations had been discontinued in children's primary teeth and pregnant women. There has also been a significant reduction in the number of teeth restored by amalgam over the last ten years due to the reductions with quotas. In previous years, third-year students were required to complete a class two amalgam restoration for the examination; however, this has now changed to composite.

DISCUSSION

The teaching of dental amalgam is continuing in the discipline. The participants have revealed that the students are placing more composite restorations in the dental clinic. The teaching time for composite restorations has increased compared to teaching time for amalgam. One of the most common challenges expressed by all participants was increased student numbers at the university. Clinical supervisors have mentioned that the students' supervision and clinical teaching was greatly impeded due to the restricted time constraints. This sentiment was echoed in a study that agreed a significant problem arises when student intake needs to increase to meet the national imperative, which will further compromise the current clinical training platform.[15] From the discussion, it was found that as dental therapists, the skills gained through preparing an amalgam cavity is of vital importance as dental therapy students do not have the opportunity to gain skills by preparing cast restorations as dentistry students do. However, this aspect of dental training needs to be questioned about how prepared students are for the 'real world' compared to preparing ideal cavity preparations in the preclinical laboratory. The problem with this type of training is that it is only focused on developing technical skills in a hospital-oriented care approach without a broader understanding of its application in the context of primary care orientation.[16]

Another challenge in training was the quota requirement for dental restorations. It has been discovered from a study carried out with dental therapy students that their preferred

Table 3 Recommendations for curriculum development

Sub-theme	Description	Participants Response
1.The Minamata Convention and its implications	Most of the participants were aware of the convention and its recommendations regarding the phase-down of dental amalgam	Focus 2, P6: 'Whilst I have heard of the conference and its implications, instead of the conference trying to influence people, I think that it is a personal choice.' Focus group 2, P5: 'I heard about the conference and the phasing down, and one of the conclusions from that conference is that until they find a total replacement material for amalgam, they will not do away with amalgam. So I think that it's still in use today because of that.'
2. Continuing professional skills of participants	The decisions made by the participants were evidence-based as the participants update their knowledge and skills by attending conferences, reading peer-reviewed journals and participating in continuous professional development assessments	Focus group 2, P2: 'I follow CPD events, I attend seminars and do CPD questions.' Focus group 2, P6: 'I do quite a bit of reading on journal articles and CPD events.' Focus group 1, P8: 'I read up on new research that comes up, and basically, I attend conferences and talk to the reps from 3M. I educate myself with the products.'
3.Skills gained for an amalgam cavity preparation	Participants agreed that amalgam cavity preparation requires more skill when teaching. However, they were divided in their opinion as to whether this was acceptable.	Focus group 2, P6: 'in our university, I think that we still use it (amalgam) to ensure that students have that finer skill to cut a cavity.' Focus group 2, P7: 'it's a nice cavity prep to start out with to teach basic concepts like resistance form, outline form and for all those kind of things and obviously for them to learn in terms of carving.' Focus group 2, P6: 'with amalgam, you have to have sound walls, the floor (of the cavity) must be correct, you must have the correct angles and so on. Its easier to place a composite because you just follow the cavity.' Focus group 1, Pii: 'For amalgam, the preclinical training is a little more intense than for composites. Cavity preparation has to be done in a specific way.' Focus group 1, P5: 'I think that we are trained theoretically to conserve tooth structure, so when it comes to amalgams, it tends to destroy quite a lot of healthy tooth structure, just to retain the amalgam.'
4.The teaching and training trends regarding dental amalgam locally and internationally	The participants were asked where they had qualified and the trends regarding dental amalgam at their respective training institutions. Participants were trained at various South African universities and some abroad	Focus group 1, Pv: 'we have a quota as well. We still have to do a certain number of amalgams, gold as well.' Focus group 1, P vi: 'Well, I finished off in Bangalore (India), and I came down to UWC and did my boards…..So at both institutions, amalgam was still being taught, so was composite.' Focus group 1, Piv: 'qualified in Kwa-Zulu Natal, …. Yes we have been doing amalgam.'
5.Guidelines to regulate quota for dental amalgam	All participants agreed that there were no clear-cut guidelines from any council, such as HPCSA, to regulate the students' quotas for dental materials. Participants explained that they followed what had been carried out from previous years.	Focus group 2, P3: 'I also feel that the council and the HPCSA should give us some guidelines with regards to this as well so that we can follow their guidelines in time to come.' Focus group 2, P6: 'In South Africa, with the HPCSA, we don't have any guidelines as such. My understanding is that the guidelines have been set up by the lecturers prior to this.' Focus group 2, P2: 'The only input that I have given was for the booklets, a clinical record book. I just go according to what I am supposed to be doing from the module descriptor and the coordinator.' Focus group 2, P6: 'The Zimbabwe dental therapist association council where they actually have instructions as to how many amalgams should be placed and which type. I know when I worked in Australia, for example, as part of our registration exams, we had to fill in a certain number of quotas, and in New Zealand as well.'
6.Should amalgam be replaced entirely in dental training?	The participants had mixed reactions regarding this question, with clinical supervisors believing that amalgam still has a place in dental training. Fifty percent of the academics felt that training in amalgam should be stopped.	Focus group 1, Pv: 'If they came up with something that was similar with far less mercury or with no mercury, by all means, but at the moment, I wouldn't say it's obsolete yet.' Focus group 2, Piii: 'I think that it should just be a case by case decision. It's difficult to say that one material should completely replace the other.' Focus group 2, P6: 'My view is different, I think that we have to face reality, amalgams are outdated, they're antiquated, it's poisonous to the environment, it's poisonous to the practitioners, the waste disposal is an issue, and internationally the trend is to move away from amalgam, unfortunately, because we have been trained with amalgam, we are still doing it. my view is that we should move away from amalgam, and we should amalgam-free.' Focus group 2, P8: 'Personally, I feel that it should. It's my personal feeling because I don't do amalgams at all. So personally, I feel that it should. I feel that they shouldn't even waste their time on amalgam. They should phase it out. Also, because of the mercury content. And when you go into private practice, you find that it is not being used.'

material for restorations is resin composite. However, the curriculum overview revealed that dental amalgam's clinical quota requirement was still present at approximately twenty percent of the total restorations placed. This does pose a stressful exercise for students as they place composite resins more often, and towards the latter half of the year, they are obliged to place amalgam restorations just to complete clinical requirements. Additionally, dental students are faced with stress related to clinical sessions and patient management. These include late or failed patient appointments and clinical quotas.[17] It has to be confirmed as to what impact the quota requirements have on patients. The quota requirement for amalgam at the institution being researched conflicts with most European studies showing that dental amalgam placement is between ten and nineteen percent at most dental schools.[18]

Another evident challenge is that participants showed concern regarding the safety of amalgam due to its mercury content. Most of the participants were aware that the international trend was to phase down amalgam due to that reason. They were concerned that mercury exposure could be harmful to patients, practitioners, and staff. However, in developing countries like South Africa, dental amalgam is still widely used. Oral health services are available in major urban centres but have little access to the underprivileged, disadvantaged population groups, mainly found in rural areas. Restorative dental care is extremely expensive to people living in poverty. Where oral health service exists, dental amalgam may be the material of choice in restorative dental care.

The university at present does not have an amalgam trap or correct waste disposal facilities. In various studies, this sentiment was unanimous: 'we should abandon materials that do not meet the highest biocompatibility standards or increase the patients' body burden of toxins – for the safety of the patient, families, and staff.'[19-22] It was encouraging to find out that the university's dental curriculum is keeping up to date and on-trend with the European Union to stop the placement of dental amalgam in children and pregnant women.[23] This bodes well for the future dental therapists' approach to paediatric dentistry. Dental therapists' should be encouraged not to place dental amalgam on primary teeth, as well as on children under 15 years of age and in this case GIC's or compomer should be the material of choice.

It was evident from the discussion that a challenge identified by the participants is that there is a conflict between the theoretical knowledge and that which is expected in the clinical requirements. Participants have stated that the theory being taught teaches students to conserve tooth structure, but amalgam cavity preparation requires tooth structure removal to ensure retention. The quotas still require students to perform amalgam restorations. The need and emphasis for minimal tooth removal and minimal intervention dentistry do not translate into the clinical quotas required. The skills required for an amalgam preparation are still fundamentally based on the modified technique by GV Black, which requires the removal of a healthy tooth structure to ensure adequate mechanical retention.[24] Data from the focus group discussions showed that clinical supervisors feel a need to reduce amalgam and use it only in areas where moisture control is difficult or based on individual case requirements. Participants found that students were competent with composite material even in multi-surface cavities. The dental curriculum revealed that the teaching includes bonded amalgam, which reduces the need for sound tooth removal to accommodate retention and resistance. The adhesive system introduced in bonded amalgam allows for less tooth structure removal and minimises microleakage.[25]

One of the participants' recommendations expressed a desire for more clinical time for students to enhance their clinical expertise with their theoretical knowledge. The data indicated a strong propensity towards composite restorations, but participants still feel that it is essential for students to gain amalgam preparations' clinical expertise even if it is only in the preclinical phase. There was a need to reduce the actual clinical quota for amalgam restorations in the clinic. The choice of material should depend purely on a case -by case indication. The authors believe that amalgam restorations should be restricted to class ii and multi-surface restorations if at all necessary.

The majority of the academic focus group participants were aware of the Minamata Convention compared to the clinical supervisors, where just seventeen percent of the participants had heard of it. Some of the key objectives of the convention included adopting national objectives aimed at minimising mercury usage; promoting the use of cost-effective mercury-free alternatives, the promotion of research and development of mercury-free materials for dental restoration; promoting the use of best environmental practices in dental facilities to reduce the release of mercury and mercury compounds to water and land.[26]

However, all participants were aware of the phase-down of dental amalgam. Their choice towards composite restoration was not guided by the Minamata Convention but rather by the need for aesthetics and minimal tooth removal. The participants were all aware of the international trend regarding dental amalgam and its phase-down, and many have felt that the university should also follow in that direction. One of the Minamata Convention requirements is that all facilities should have the correct disposal system for dental amalgam. The university being researched does not comply.

The cost of dental materials emerged as another factor to consider, especially in a developing country like South Africa, where the majority of the population access public healthcare. These facilities usually have a shortage of electricity, water, and modern equipment to facilitate the placement of technique-sensitive dental materials such as dental composite. Dental amalgam is used in large carious areas, making it the material of choice when patients present for treatment due to its relatively lower cost, ease of use, and longevity of the material. The complete phase-out of amalgam may widen oral health inequalities unless a cheaper, longer-lasting alternative is available to primary health care providers.[26] Participants have stated that some medical aid providers do not pay for composite resins placement, which is seen as a cosmetic procedure. There must be a collaboration between private medical aid providers and the local health governing authorities to educate them about restorative materials and their applications. Consequently, the complete phase-out of dental amalgam will not be feasible as most students will be employed in the private sector, and some medical aids will still only reimburse for amalgam restorations.

Participants have also stated that there are currently no guidelines from any regulatory health council or governing body to regulate the dental curriculum and the number of restorations placed. The current dental curriculum has followed what was previously done over the years. It is expected that dental schools' academic leaders in South Africa can reach a common consensus regarding curriculum input.

The participants keep up to date with their continuing educational knowledge by attending conferences, reading journals, partaking in online CPD activities and webinars. Therefore, most of them are well aware of how the trend in dental restorative materials is evolving.

Participants displayed a mixed response when the question was posed if dental amalgam should be replaced entirely. Whilst there is concern regarding amalgam and its mercury content; its poor aesthetics; its removal of healthy tooth structure, and its staining of the tooth and surrounding tissues, there should be an equal concern with composites and its concern with micro-leakage, secondary caries, biocompatibility with oral tissues and polymerisation shrinkage. Participants have commented that until a suitable material with similar strength properties and affordability of amalgam is not found, it is unlikely that dental amalgam can be totally replaced. It was also evident from the discussion that all clinical supervisors felt that amalgam should still be available in the dental clinic, compared to twenty-five percent of dental academics who felt that amalgam should be completely replaced.

The demand for aesthetics has been noted since the 1970's when the aesthetic revolution began.[27] This could be seen as either a bane or a boon, as patients were demanding their old amalgam restorations to be replaced.[27] Some patients were concerned about mercury's toxicity, but the undeniable reason was aesthetics.[28]

This was evident from the first phase of the study by the above authors, which assessed the students' choice of material, and aesthetics emerged as the fundamental reason. The participants have indicated a trend towards minimal intervention dentistry. This includes minimal caries removal to ensure tooth preservation.[29] Minimal intervention dentistry (MID) also includes principles of correct oral hygiene, dietary and lifestyle changes, and the application of topical fluoride products and bonded amalgam.[29] This knowledge should be integrated into the curriculum of the third-year dental students as well. Presently this is conducted in the second year. Consequently, with the global Covid-19 pandemic, dentistry should undergo a reform where it should be less invasive and more preventive, reducing the need for aerosol-generating procedures.[30]

CONCLUSION

The teaching and training of dental amalgam is still an integral part of the university's dental restorative curriculum. The study revealed that the academics and the clinical supervisors had shown a stronger affinity towards the placement of composite restorations rather than amalgam. Over the years, composite resins have been taught extensively, encompassing a major portion of the dental restorative curriculum. Both the clinical supervisors and dental academics have expressed a need for the clinical quota to be revised. The amalgam restorations should be placed on a case-by-case clinical decision rather than quota driven. The dental curriculum should become more relevant for these changing times to reduce dental amalgam restorations further.

DECLARATIONS

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Ethics approval and consent to participate

The Social Sciences and Humanities Ethics Committee of the University of KwaZulu-Natal provided ethical approval (HSSREC/00000622/2019). All participants consented to participate as well as for an audio recording.

Competing interests

The authors declare that they have no competing interests.

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Dentistry in South Africa and the need for management and leadership training

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ABSTRACT

Introduction

Dental professionals face many challenges due to a rapidly changing environment, and are acknowledging the need for essential leadership skills to perform optimally. We assessed key stakeholders' views about the need for management and leadership training in dentistry in South Africa .

Aims and objectives

The aim of this study, was to assess the need for leadership and management training in Dentistry in South Africa from an industry perspective.

Design

A qualitative study.

Methods

Purposive sampling of 14 Senior Managers in the dental environment and 11 recently qualified dentists in South Africa. We conducted one-on-one and telephonic interviews guided by a semi-structured questionnaire with open-ended questions. Interviews were recorded, transcribed and data was thematically analysed.

Results

Participants expressed concerns about dentistry in South Africa. All participants mentioned financial constraints, including the high cost of setting up a practice, high cost of imported consumables and dwindling support from medical schemes. Participants stated that strong leadership and managerial skills were important for dealing with these challenges.

Conclusion

Inculcating these skills will make a remarkable difference in enhancing services and providing purposive direction within the profession.

Keywords

Dentistry, leadership; management; leadership training and development

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1. INTRODUCTION

Dental professionals are gradually acknowledging that they need to obtain important leadership skills to achieve professional competency. The extent and development of these leadership skills in the tertiary education system have not been well defined,[1] and require urgent attention because the dental profession is rapidly changing.[2] A significant decline in incidence of dental caries and shifting disease pattern,[3] in the wake of increasing demands from patients' high expectations, challenges with medical aid coverage and occupational safety has altered the face of the dental profession.[4] In addition, also consequent to the link between oral infections and systemic diseases, developing health reforms compete with the traditional model and scope of practicing.[5] South African dentists urgently need to acquire leadership and management skills to enhance their optimal performance in complex environments.[6]

Dental education and training encompasses a wide range of skills, but leadership skills are rarely purposefully cultivated. In South Africa, dental students' training is largely centred around clinical practice, despite evidence showing that dental students believe that leadership skills are imperative in their education.[7] Studies also show that dentists in private practice support the development of leadership skills during tertiary training, since these skills are lacking in practice.[8]

South Africa is facing many healthcare challenges, which may be mitigated through the development of leadership skills, encouraging health professionals to work together for the benefit of the South Africa population.[9] Irrespective of legislative measures granting good policies, a shortage of leadership and management skills complicated by insufficient

attention to health inequalities, have a considerable impact on how the healthcare system is implemented.[10] A recent study in South Africa found that dental students recognised the need for training in non-clinical, as well as clinical skills.[11] The majority of them were hoping to engage themselves with the private sector in the future, however, these hopes may be modified under the transformation of dental education within the last two decades, including ongoing social redress being directed at racial profiling in the universities.[12] The students expressed a need for leadership and management training in dental schools in South Africa. To date, there has been no consensus on this topic from the other key stakeholders in the dental fraternity. We add to the perspectives of dental students, by assessing the views of dental senior managers and practicing South African dentists. In this study we assessed key stakeholders' views about dentistry in South Africa, and if they believed there was a need for management and leadership training in dentistry. Our findings will shed light on the professional environment of dentistry in South Africa and prompt educators to make evidence-based decisions on the urgency of including or developing leadership and management in dentistry curricula.

2. METHODS AND MATERIALS

Ethical approval (352/2016) was granted from the University X Ethics Committee.

2.1 Study design

For this qualitative study, we purposively sampled senior managers and practising dentists. Our sample included 14 dentists in Senior Managers, and 11 recently qualified dentists. The Senior managers included dentists from reputable public and private oral health organisations, including the South African Dental Association (SADA), Dental Professionals association (DPA), group practices (Intercare and Medicare), South African Military Health Services (SAMHS), Public Health Services (National Department of Health and the regional Tshwane district) and five private dentists. Dentists were selected due to their role, experience and ability to provide valuable information on management and leadership pertaining to oral health in South Africa.

The Young dentists included dentists from the public (n=5) and private (n=6) sectors, who qualified between 2002 and 2015, and were younger than 35 years old. Dentists represented four of the nine provinces in South Africa, namely Gauteng, Kwa-Zulu Natal, Mpumalanga and Western Cape.

All the participants were invited telephonically or via email. The emails sent contained the title and objectives of the research study, the nature of the involvement of the participants and what was expected of them. Participants who indicated interest in being part of the study, signed an informed consent.

2.2 Data collection

Data were collected during semi-structured interviews, conducted either in person or telephonically.[13] The study was approved by the University X Ethics Committee (352/2016). The Senior Managers and Young Dentists were asked a set of pre-determined open-ended questions: *"What are your views about dentistry in South Africa?", "Do you think there is a need for leadership and management training in dentistry in South Africa?" and "Do you know of any initiatives focusing on leadership* and *management training in dentistry in South Africa?"* We also asked the Young Dentists whether they felt that their dental training had satisfactorily equipped them with appropriate non-clinical skills to successfully launch a dental practice.

2.3 Data analysis

We coded each participant to ensure anonymity i.e. SM01-SM14 (Senior Managers) and YD01-YD11 (Young Dentists). Interviews were audio-recorded, and responses were transcribed verbatim, and thematically analysed.[14]

3. RESULTS

3.1 The state of dentistry in South Africa

From the question assessing the perceptions of dentists on the state of dentistry in South Africa, we identified three themes, including (1) Expensive and unaffordable dental services; (2) Reduced pay-outs from third party funders; (3) Marginalisation of dentistry from other medical professions within the health sector.

Expensive and unaffordable dental services

All the participants agreed that the dental profession in South Africa is undergoing major challenges.

"The dynamics and diversity of South Africa as a country makes it even more challenging" (SM13).

Most (n=10) of the SMs stated that dentistry is currently under strain and pressure from the external environment such as the economy. Dentists also felt that dentistry serves the overall good of the public despite being expensive. Dentistry is no longer viewed as a priority in general healthcare especially by third party funders in South Africa.

"Dentistry is expensive. People cannot afford services. Even those on medical aid" (SM05).

One participant stated that South Africa had an adequate dental system but that proper implementation was a concern,

"This starts with undergraduate training where teaching should be centred on the primary healthcare approach i.e. prevention and promotion, early diagnosis/detection, curative, and rehabilitation, instead of largely on curative, as was mainly the approach currently. This primary healthcare approach will benefit oral health in general and the society as a whole" (SM14).

Most (n=8) Young Dentists felt that dentistry in South Africa was highly constrained and challenging. These challenges included dentistry being demanding, and medical counter parts not viewing oral health as a priority, and therefore delaying referrals. Dentists also mentioned economic fluctuations as a challenge, including often-volatile exchange rates affecting the cost of imported dental consumables.

"Another pressure also is our exchange rate which is been very volatile. Everything is imported and subject to the dollar, pound or euro" (YD07).

Reduced pay-outs from third party funders

Almost half (n=6) of SMs agreed that the dental profession was seriously threatened by reduced pay-outs from medical

schemes. Dental services have become an out of pocket expenditure for most clients.

"I love clinical practice, but the main frustration is with the reduction in medical aid pay-outs leading to poor treatment planning and overcompensating with a heavy workload" (SM06).

Two Young Dentists also suggested that there was a need to acquire leadership and management skills to effect relevant changes regarding medical schemes.

Marginalization of dentistry from other medical professions within the health sector

Three Senior Managers noted that the dental profession is being marginalised by their medical health counterparts. Participants suggested that dentistry should be prioritised in the health agenda of South Africa. The lack of advocacy for dentistry in South Africa was attributed to a lack of management and leadership skills in the profession.

"We need leaders in dentistry that will collaborate dentistry with private stakeholders and boost the economy. We need leaders and managers in dentistry that will now effect a change with collaboration because we are isolated" (SM03).

Three Young Dentists also expressed concerns that oral health might not be considered important for general health and wellbeing and mentioned that more attention should be placed on oral health resources. Participants mentioned that this is particularly relevant in the public sector, where awareness of dentistry should be emphasised. One participant highlighted funding conflicts between dentistry and medicine and pointed out the disconnect between dentistry in the private and public sectors. One Young Dentist who previously worked for the public sector, stated that there were too few dentists in the public sector, posing a challenge and alluding to the huge demand for services.

3.2 The need for leadership and management training in South Africa

Participants acknowledged that management and leadership were often used interchangeably. Senior Managers confirmed the need for both management and leadership amongst dentists in South Africa.

"Definitely a need for both. Leadership: to get things done through people working together to share and implement your vision. On the operational side of things as well, managers are needed" (SM07).

Senior Managers agreed that there is an incorrect perception that leadership skills develop with clinical experience and age. All (n=5) the private sector Senior Managers, unanimously supported that management and leadership skills were a critical requirement for dentists. This is because, most qualified dentists in South Africa end up in the private sector during the course of their career. Some dentists will eventually manage their own practices, and one Senior Manager mentioned that these dentists are business owners and should have a general knowledge of human resources and development, finances, fixed and variable costs, and how these affect the business. As leaders, dentists should be able to forecast, look into the future and have a vision of how they are going to take the practice forward. This speaks to entrepreneurial thinking and vision.

Most of the Young Dentists (n=8) agreed that dentists need both management and leadership skills. One Young Dentists mentioned that clinical skills were the primary focus of dental training. Most dentists qualify with adequate clinical competency, proficiency and knowledge, but without the non-clinical skills needed to work as part of a team rather than running a one-person show.

Five Senior Managers and two Young Dentists felt that there was a stronger need for management training. According to one Senior Manager, many South African dentists leave the management of their practices up to their non-clinical staff. Many dentists in private practice lack knowledge about staff, stock control, equipment, supply chain and service providers. Only three Senior Managers and one Young Dentist favoured leadership training. Only one Young Dentist, who was foreign trained, felt that he was adequately trained in non-clinical skills. The rest of the Young Dentists felt they lacked the necessary non-clinical skills. Only eight Senior Managers and five Young Dentists knew of self-sought management courses offered by professional bodies. Participants felt that the general management courses organised by the academic institutions for dental students were rather broad, and not structured to suit the dental curriculum. Only three Senior Managers and three Young Dentists identified a few leadership development initiatives. These participants wished to see leadership initiatives relevant to the dental profession.

4. DISCUSSION

In this study, we assessed the perceptions of practising dentists regarding how they perceived dentistry in South Africa, and if they felt there was a need for management and leadership training in dentistry in South Africa. As a whole, participants were pessimistic about dentistry in South Africa. Participants were frustrated at the high input costs, inadequate funding due to increasing pressure from third party funders and marginalization of dentistry.

In South Africa, medical aid coverage dropped from 18% in 1996 to 11% in 2003, implying that an increasing number of patients are attending the already overburdened public healthcare facilities.[15] More than 80% of the private practices in South Africa depend on medical aid, providing expensive private dental care to those who are able to afford monthly medical aid payments.[16] The significant challenge in dentistry in South Africa, is connected to the considerable social and economic inequalities of South Africans stemming from a history of apartheid.[17]

Socioeconomic disparities mean that many people are unable to afford dental treatment,[18] due to the high rate of unemployment amongst South Africans.[19] Dentists are thus put under pressure by dwindling numbers of patients, and high costs of setting up surgeries and having to import expensive consumables.

The situation in dentistry has been made more difficult by the increasing complexity of health in South Africa, which disregards dentistry as a health priority. [20-21] Most dental services are rendered to relieve pain and sepsis, regardless of the need for advanced treatment.[21] In South Africa, there

are good health policies, but the lack of good leadership and management has hindered the full implementation of many policies.[10] South Africa needs leaders and managers in strategic positions who can motivate for transformation and implement policies to improve oral healthcare service delivery in South Africa.

In this study, all participants agreed that dentists need management and leadership training. Participants recognised that not having these skills resulted in real leadership and management challenges. Other studies recognise the importance of leadership skills for dentists since they inevitably end up leading their own teams.[22-23] These skills are needed to encourage change and innovation while at the same time equip professionals to master challenges.[22] Most of the Senior Managers and Young Dentists confirmed that they did not have the sufficient training in non-clinical skills to adequately prepare them for dental practice. The Senior Managers confirmed that they did not receive any management training during their undergraduate dental training. This was contrary to the Young Dentists, who ran modules in Dental Practice Management as part of their undergraduate curriculum, but still felt inadequately prepared for leadership roles in the dental profession.

Dental professionals should be trained in leadership knowledge and skills.[24] Yet, dental schools have not adequately incorporated the necessary leadership skills to prepare dental professionals for leadership roles.[25-27] Dental students are generally not trained to become proficient in non-clinical skills, such as communication and teamwork. Imparting management and leadership training early at undergraduate level could potentially have remarkable benefits. Apart from a better understanding of how to lead a dental team, this training could assist educators to quickly recognise future leaders. Students could aspire to and grow into awareness of their innate leadership abilities.[25] Participants further revealed that there were few initiatives developing leadership and management skills in dentistry in South Africa.

Dentists in South Africa, are experiencing significant challenges, both in the public and private sectors. Dentists require leadership and management training to deal with these challenges. Dental institutions need to review their curricula to incorporate management and leadership training. This study contributes to the scarce literature around leadership and management skills in dentistry.

5. LIMITATIONS OF THE STUDY

The sample size was relatively small, which may affect the generalisability of the study. It could however be argued that the key stakeholders who were consulted in this study were fairly representative of the incumbent organisational leadership in dentistry in South Africa. Young Dentists also originated from multiple training institutions to give a perspective of their recent education.

6. CONCLUSION

Key stakeholders' opinions advocated that dentists in South Africa are very pessimistic about the changing environment. There are clear indications that they are inadequately equipped to deal with funding frustrations and the alleged marginalization of dentistry. Dentistry is perceived to be less important in the South African healthcare system. Leadership and management skills are required to ensure the sustainability of dentistry as a profession, and contribute appropriately to the healthcare system.

Conflicts of Interest

The authors have no conflicts of interest to disclose.

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Do the CPD questionnaire on page 571

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.

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Survival of Patients with Floor of Mouth Squamous Cell Carcinoma Treated with Surgical Resection and Reconstruction

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ABSTRACT

Background

To identify predictors of survival in patients with floor of mouth Squamous Cell Carcinoma (FOMSCC) in order to improve patient selection for resource intensive resection and reconstruction procedures.

Methods

A retrospective record review of patients who underwent resection and reconstruction for FOMSCC at Charlotte Maxeke Johannesburg Academic Hospital. Patient data were collected and analyzed with respect to age, sex, race, tobacco usage, alcohol usage, tumour stage and postoperative chemo-radiation. One- and five-year recurrence and survival rates were also evaluated.

Results

Within the study period, 20 patients were identified that were treated with resection and reconstruction for FOMSCC. The mean age at diagnosis was 56.85 years, with 70 percent of the sample being male and fifty percent being black. Amongst the sample, 90 percent of patients used tobacco and 60 percent were frequent alcohol users. The most common stage at diagnosis was stage IVA which was found in 40 percent of the sample.

There were no significant factors associated with recurrence at 1 year. At 5 years, alcohol usage was a significant predictor of recurrence (P=0.044).

There were no significant factors associated with death at 1 year however tumour stage at 5 years was a significant predictor (P=0.035).

Out of 20 patients, five patients had recurrence. Total person-time was 72.9 person-years, with a mean follow-up time of 3.65 (SD 2.04) years per person. Out of 20 patients, nine patients died within 5 years (45%). Alcohol was the only statistically significant factor associated with increased mortality

Conclusion

Our findings suggest earlier diagnosis, and active treatment of early stage disease may be the best means of improving 5-year survival rates. Efforts to improve quality of care and manage limited resources should concentrate on choosing the appropriate disease stage for surgical management, improve cancer surveillance and strengthen referral system so as to improve early detection of disease and provide social support and counselling for adjunctive habits such as alcohol and tobacco use cessation which will improve patient outcomes.

Keywords

Floor of mouth squamous cell carcinoma. Survival, Recurrence

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2. **Shivesh Maharaj:** Concept and editing

INTRODUCTION

Oral cavity malignancies are the eighth most common cancer worldwide.[1] Floor of mouth malignancies are the second most common sub-site in the oral cavity after tongue malignancies.[2,3] Globally 95% of oral cavity malignancies are squamous cell carcinoma (SCC).[2,4]

The floor of mouth is defined as the mucosal surface below the tongue bordered by the alveolar ridge laterally and anteriorly, and the oral tongue posteriorly and medially.[5] The lingual frenulum divides it in the midline. Its deep margin is the mylohyoid muscle. The contents include the sublingual glands, the deep portion of the submandibular gland, the sub-epithelial minor salivary glands, the deep lingual vessels, Wharton's duct and the lingual nerve.[5] The arterial supply to the floor of the mouth is from the dorsal lingual, sublingual, and deep lingual branches of the lingual artery. The venous drainage is via the lingual veins that drain into the facial and retromandibular veins.[5] The lingual nerve provides general sensory innervation to the floor of the mouth and tongue as well as special taste sensation through the accompanying chorda tympani branch of the facial nerve.5 Primary neoplasms may arise from the mucosa, salivary glands, muscle or neurovascular tissues.[5]

Table I: Overall characteristics of patients with FOMSCC	
Variable	N (%)
Demographics	
Age, mean (standard deviation)	
Gender	
Male	14 (70.0)
Female	6 (30.0)
Race	
Black	10 (50.0)
White	8 (40.0)
Coloured	2 (10.0)
Risk Factors	
Tobacco users	18 (90.0)
Alcohol users	12 (60.0)
Clinical findings	
Stage at diagnosis	
Stage I	3 (15.0)
Stage II	3 (15.0)
Stage III	6 (30.0)
Stage IVA	8 (40.0)
Treatment	
Chemo-radiation received	14 (70.0)
Outcomes	
Recurrence at 1 year	1 (5.0)
Recurrence at 5 years	5 (25.0)
Death by 1 year	2 (10.0)
Death by 5 years	9 (45.0)

Lymphatic drainage of the floor of mouth is via the cervical lymph nodes. The first echelon lymph nodes of the floor of mouth are located in the supra-omohyoid triangle.[6] The lymphatic channels accompany the lingual venous system, and their density increases from the anterior to the posterior. Lymphatic metastases generally occur in a predictable fashion, but skip lesions may be noted.[2]

Risk factors known for development of oral SCC (OSCC) are tobacco usage, alcohol consumption, nutritional deficits (carotenoids & vitamin A, C and E), Fanconi's anaemia, a genetic predisposition, Human Papilloma Virus infection, previous head and neck malignancy and radiation exposure. Betel quid chewing (made of the areca nut wrapped in betel leaf) amongst the Asian population is also known to be a strong risk factor.[5]

Premalignant lesions which represent varying degrees of epithelial dysplasia are also a significant risk factor for oncogenesis. The most common premalignant lesions in the oral cavity are leukoplakia, erythroplakia, and submucous fibrosis.[5]

The Tumour, Node, Metastases (TNM) staging system devised by the American Joint Committee of Cancer (AJCC) is used to categorize malignancies of the oral cavity (Appendix 1). The staging assists with assessment of disease status, prognosis and management.[7] All available clinical findings may be used in staging including physical exam, radiologic, intraoperative, histopathology and biomarkers.[8] Stage of disease at time of treatment initiation is a very important predictor of survival in OSCC.[7] It is widely

Table II: Factors associated with recurrence at 1 year and 5 years

Factors	Death at 1 year (N=20)			Death at 5 years (N=17)		
	Alive N (%)	Dead N (%)	P value	Alive N (%)	Dead N (%)	P value
Age, mean (standard deviation)	57.78 (14.62)	48.50 (9.19)	0.398	58.25 (17.0)	57.78 (10.05)	0.944
Gender						
Male	12 (84.71)	2 (14.29)	1.000	4(33.33)	8(66.67)	0.131
Female	6 (100.0)	0 (0.0)		4(80.0)	1(20.0)	
Race						
Black	8 (80.0)	2(20.0)	0.579	3(42.86)	4(57.14)	0.444
White	8 (100.0)	0(0.0)		5(62.50)	3(37.50)	
Coloured	2 (100.0)	0(0.0)		0(0.0)	2(100.0)	
Tobacco						
Non-users	2 (100.0)	0(0.0)	1.000	1(100.0)	0(0.0)	0.471
Tobacco users	16 (88.89)	2(11.11)		7(43.75)	9(56.25)	
Alcohol						
Non-users	8 (100.0)	0 (0.0)	0.495	5 (83.33)	1 (16.67)	0.05
Alcohol users	10 (83.33)	2 (16.67)		3 (27.27)	8 (72.73)	
Stage at diagnosis						
Stage I	3 (100.0)	0 (0.0)	0.747	3 (100.0)	0 (0.0)	0.035
Stage II	3 (100.0)	0 (0.0)		2 (100.0)	0 (0.0)	
Stage III	6 (100.0)	0 (0.0)		2 (33.33)	4 (66.67)	
Stage IVA	6 (75.0)	2 (25.0)		1 (16.67)	5 (83.33)	
Chemo-radiation received						
No	6 (100.0)	0 (0.0)	1.000	4 (66.67)	2 (33.33)	0.335
Yes	12 (85.71)	2 (14.29)		4 (36.36)	7 (63.64)	

Table III: Factors associated with death at 1 year and 5 years

Factors	Recurrence at 1 year (N=20)			Recurrence at 5 years (N=15)		
	No recurrence	Recurrence	P value	No recurrence	Recurrence	P value
Age, mean (standard deviation)	57.63 (14.22)	42	-	55.4 (12.28)	58 (11.55)	0.0702
Gender						
Male	13 (92.86)	1(7.14)	1.000	5 (50.0)	5 (50.0)	0.101
Female	6 (100.0)	0(0.0)		5 (100.0)	0(0.0)	
Race						
Black	9 (90.0)	1 (10.0)	1.000	3 (50.0)	3 (50.0)	0.336
White	8 (100.0)	0 (0.0)		6 (85.71)	1 (14.29)	
Coloured	2 (100.0)	0 (0.0)		1 (50.0)	1 (50.0)	
Tobacco						
Non-users	2 (100.0)	0 (0.0)	1.000	1 (100.0)	0 (0.0)	1.000
Tobacco users	17 (94.44)	1 (5.56)		9 (64.29)	5 (35.71)	
Alcohol						
Non-users	8 (100.0)	0 (0.0)	1.000	6 (100.0)	0 (0.0)	0.044
Alcohol users	11 (91.67)	1 (8.33)		4 (44.44)	5 (55.56)	
Stage at diagnosis						
Stage I	3 (100.0)	0 (0.0)	1.000	3 (100.0)	0 (0.0)	0.384
Stage II	3 (100.0)	0 (0.0)		2 (100.0)	0 (0.0)	
Stage III	6 (100.0)	0 (0.0)		2 (40.0)	3 (60.0)	
Stage IVA	7 (87.50)	1 (12.50)		3 (60.0)	2 (40.0)	
Chemo-radiation received						
No	6 (100.0)	0 (0.0)	1.000	5(83.33)	1(16.67)	0.580
Yes	13 (92.86)	1(7.14)		5(55.56)	4(44.44)	

accepted that the advanced stage (Stage III and IV) cancers of the oral cavity have lower disease free and overall survival rates compared to early cancers.[3,8–11]

The prognostic implications of currently accepted pathologic features continue to be under investigation (histologic grade, lympho-vascular invasion, perineural invasion, and extracapsular spread of disease).[10] Histological features such as the grade of the lesion reflects the aggressiveness of the tumour, that, in itself has not been shown to be an independent parameter of prognosis on multivariate analysis.[11,12] Other studies however have shown that the grade of tumour does affect survival.[3,10] The most important histologic feature of the primary tumour is its depth of invasion, which has been shown to be directly correlated with survival rate.[11,12]

Depth of invasion has now been incorporated in the latest edition of the AJCC Primary tumour staging for oral cavity tumours (eighth edition) (Appendix 1). Treatment strategies are aimed to maximize locoregional tumour control and address the functional impact of a procedure on speech and swallowing.

The tumour factors that affect the choice of initial treatment of oral cancer are primary site, size (T Stage), location (anterior versus posterior), proximity to bone (mandible or maxilla), status of cervical lymph nodes and previous treatment.[6,13,14]

Stage IVA disease indicates moderately advanced disease but is still considered to be surgically resectable. Stage IV B and stage IV C disease is very advanced disease and is considered to be unresectable.[7]

T4a tumours that are treated surgically often result in large composite tissue defects that need to be reconstructed for functional and aesthetic outcomes.[15,16] Reconstructive options include grafts, local or regional flaps as well as free tissue transfers from different sites, most commonly the leg, thigh and forearm.[15-17]

Primary treatment with Radiotherapy is not favoured due to the close proximity of the oral cavity sub-sites to bony structures such as the mandible and maxilla, which can lead to complications such as osteoradionecrosis of these structures.[3,8,18] Thus, surgical resection has been advocated as the primary treatment for most oral cavity malignancies, with reconstruction for large defects.[17] Adjuvant chemo-radiation has been advocated for advanced tumours stage (III/IV) positive post-surgical margins, multiple positive neck nodes, extracapsular extension, perineural or intravascular invasion, and bone, cartilage and soft tissue invasion.[8,18]

Thirty percent of patients with FOMSCC present with regional metastases and the overall 5-year survival varies from 30-76%.[10,11,13,14,19]

The primary objective of the study is to evaluate FOMSCC in our department by reporting one- and five-year overall survival rates, disease free survival and mortality rates for each stage of FOMSCC.

The secondary objective of the study is to report on demographic data of patients in the study as well as correlate these data with survival and mortality rates. These procedures use up multidisciplinary resources such ENT surgeons, plastic surgeons, maxillofacial surgeons

Table IV: Cumulative survivor function for recurrence					
Time from surgery (in years)	Total at the beginning of period	Number of recurrences	Survivor Function	95% CI	
1	19	1	0.9474	0.6812	0.9924
3	10	4	0.7152	0.4425	0.8712
5	8	0	0.7152	0.4425	0.8712

Table IV: Cumulative survivor function for recurrence					
Time from surgery (in years)	Total at the beginning of period	Number of recurrences	Number of deaths	95% CI	
1	19	2	0.9000	0.6560	0.9740
3	10	7	0.5385	0.2990	0.7280
5	8	0	0.5385	0.2990	0.7280

and prosthodontists as well as various allied disciplines.[20] They are also associated with prolonged theatre times, prolonged ICU admission and prolonged hospital stays.[20,21]

MATERIALS AND METHODS

Study design
The study is a retrospective review of available clinical records.

Study Population
Patients diagnosed with FOMSCC who underwent oncological resection and reconstruction at CMJAH between January 2008 till December 2017 were included in the study.

Inclusion criteria
All patients with documented FOMSCC that underwent surgical resection.

Exclusion criteria
Patients with inadequate data in their clinical records.
Patients who could not be contacted or traced in order to determine survival.

Data Collection
Data was collected from theatre records, hospital file records, National Health Laboratory System records, ENT out-patient department records, patient/family telephonic interviews.

Recorded variables
Patient Demographics
- age at diagnosis
- gender
- race

Risk Factors
- Smoking habit
- Alcohol use
- Clinical findings
- Tumour staging at diagnosis
- Treatment
- Chemo-radiation received

Outcomes
- recurrence at 1 years
- recurrence at 5 years
- death by 1 year
- death by 5 years

Limitations of the study
This study is limited by the small sample size which could be due to the selection a single Oral SCC sub-site to reduce confounding variables.

Histopathological findings have been found to have significant prognostic markers. However, these findings were not consistently documented in the histology reports, therefore could not be accurately assessed in this study.

Poor clinical record keeping was a limitation in our study in terms of using patients clinical background such as comorbidities and overall nutritional status as predictors of survival. Prospective collection of this data will, in future, allow for a deeper analysis of the factors associated with recurrence and survival of these patients.

Ethics was granted by the Wits human and ethics research council, ethics clearance certificate number M190527.

RESULTS AND DATA ANALYSIS

All analyses were done using Stata version 15. Statistical significance was set at 5%. Overall patient characteristics were tabulated. Frequencies and percentages were used to describe categorical variables; mean and standard deviation were used to describe the age. In bivariate analysis, characteristics of patients who had recurrence and those who did not were compared.

Comparisons of recurrence at one year and 5 years were made using Fisher's exact tests for categorical variables and Student's T-test for age. Similarly, characteristics of patients who died and those who survived at one year and 5 years were compared.

Time-to-event analyses were used to estimate time to recurrence and time to death. For recurrence, time was calculated from date of surgery to date of recurrence or date of death for those who died before recurrence, or date of database closure (30 November 2019) for those who did not die and did not have recurrence.

For death, time was calculated from date of surgery to date of death or date of database closure (30 November 2019) for those who did not die. We reported number of recurrences and deaths and mean follow-up time. Kaplan Meier cumulative survival curves for death and mortality were plotted and log rank tests were used to compare survivor curves.

Adjusted and unadjusted Cox regression models were fitted to help identify predictors of mortality in patients with FOMSCC post-surgery.

RESULTS

Patient demographics

Within the study period, 20 patients were identified that were treated with resection and reconstruction for FOMSCC (Table I). The mean age at diagnosis was 56.85 years, with 70 percent of the sample being male and fifty percent being black. Amongst the sample, 90 percent of patients used tobacco and 60 percent were frequent alcohol users. The most common stage at diagnosis was stage IVA which was found in 8 patients (40 percent of the sample).

Bivariate analysis - Factors associated with recurrence

There were no significant factors associated with recurrence at 1 year (Table II). At 5 years, alcohol usage was a significant predictor of recurrence (P=0.044).

Bivariate analysis - Factors associated with death

There were no significant factors associated with death at 1 year however tumour stage at 5 years was a significant predictor (P=0.035) (Table III).

Survival analysis - Time to recurrence

Out of 20 patients, five patients had recurrence. Total person-time was 72.9 person-years, with a mean follow-up time of 3.65 (SD 2.04) years per person (Table IV).

Mortality - Time to death

Out of 20 patients, nine patients died within 5 years (45%). Total person-time was 72.9 person-years, with a mean follow-up time of 3.65 (SD 2.04) years per person (Table V).

Predictors of mortality

Alcohol was the only statistically significant factor associated with increased mortality (Table VI).

DISCUSSION

Patient Demographics

The data collection identified 20 patients with complete records treated for FOMSCC from 2008 to 2017. The age range of 56.85 (14.28) as well as the gender distribution was in keeping with previously reported studies where the peak age range of affected patients in the literature is 45-65.[4,17]

FOMSCC has historically affected males more frequently than females however, there is an increasing incidence in females due to the rise in smoking and alcohol consumption rates in females.[4,17] In this study seventy percent of patients were male and 30 percent female in keeping with the male predominance reported in the literature.[4,17]

In South Africa, oral SCC predominates in black males followed by Caucasian males.[4] Racial demographics were the same as other studies, with black predominance, followed by white then coloured.[4] The stage of tumour at presentation was more advanced in keeping with findings from other third world centres.[11] This could be due to delays in appropriate referral of patients or due to delays in seeking treatment by patients due to social, educational and economic factors. Seventy percent of patients received chemo-radiation as an adjunct to surgery, this is in keeping with international guidelines.[18]

Factors associated with recurrence

We had a 5-year recurrence rate of 25% which is lower than that reported by Masoudi et al who had a 41% 5-year recurrence rate.[9] There was a higher number of recurrences (1 versus 5) as well as deaths (2 versus 9) from the study sample at five years compared to one year, which is in keeping with data reported by Ong et al.[8] Our study showed that overall risk for recurrence increased from year 1 to 3 then stabilized. The risk of recurrence was more likely in males over females, Coloureds over Blacks and Blacks over Caucasians. Tobacco users carried a higher risk of recurrence over non–tobacco users. Those patients with stage III and stage IVA disease had a higher risk of recurrence.

An interesting observation is that patients who received adjuvant chemo-radiation had a higher risk of recurrence than those who had surgery only, however these risks were not statistically significant possibly due to the small sample size, and except for the data on chemo-radiation, these trends are in keeping with those reported in the literature.[22]

Bivariate analysis showed no significant risks factors to predict recurrence at one year, however there was a significant association of recurrence (P=0.044) at five years with alcohol use. Perhaps the continued use of alcohol post treatment or the oncogenic effects of synergistic alcohol and tobacco use allow for greater field mutations which, in turn, increase the risk of recurrence compared to non-alcohol users.

Factors associated with death

Our survival rate was 90% at 1 year and 55% at 5 years which is higher than literature reports by da Silva Moro et al. (42%), le Campion et al (28%), Santos et al. (28%), Honorato et al. (43%) and De Aurajo et al. (38%), Chang et al. (48%) and Saggi et al. (39%).11,22,23 Patient survival decreased to nearly half from time of surgery to 3 years then stabilized.

Males were found to have a higher risk of death than females, Coloureds higher than Blacks, and Blacks higher than Caucasians, although this was not found to be statistically significant. In the literature, gender has not been shown to have a statistically significant difference in survival rates.[8,11,23]

There has been conflicting findings regarding the role of age and race regarding overall survival rates with some studies showing that they have predictive value on survival whereas others have shown that they are insignificant.[10,11,23] Our findings show no statistical differences in survival based on age and race.

Tobacco chewing or smoking is one of the most prevalent risk factors identified in oral cavity SCC. There are sixty carcinogens present in tobacco smoke and at least sixteen carcinogens in unburned tobacco.[24]

In the literature smokers with a pack year history of over thirty years have a four-fold greater risk of getting Oral SCC.[5] We found that tobacco use carried a higher risk of death over non-tobacco users although this was not statistically significant (P=0.304).

Table VI: Predictors of mortality

Factors	Unadjusted Cox Regression Models			Adjusted Cox Regression Model		
	Hazard Ratios	95% CI	P Value	Hazard Ratios	95% CI	P Value
Age	0.99	0.95 – 1.04	0.955	0.91	0.82 – 1.01	0.096
Gender						
Male	Reference					
Female	0.21	0.02 – 1.69	0.142	-	-	-
Race						
Black	Reference		Reference			
White	40.7	0.17– 3.33	0.700	4.77	0.45– 50.82	0.196
Coloured	8.71	1.10 – 69.06	0.040	9.63	0.88– 105.46	0.064
Alcohol						
Non-users	Reference			Reference		
Alcohol users	7.60	0.95– 61.03	0.056	44.05	1.59– 1221.32	0.026
Stage at diagnosis						
Stage I - III	Reference			Reference		
Stage IVA	2.85	0.75 – 10.79	0.122	3.66	0.59 – 22.71	0.164
Chemo-radiation received						
No	Reference			Reference		
Yes	2.06	0.42 – 9.96	0.370	2.23	0.38 – 12.91	0.371

Our study also found that alcohol use carried a statistically significant (P=0.026) risk of death compared to non-alcohol users. This finding is in keeping with other studies that found alcohol usage as a significant predictor of low survival rates.[11] Alcohol use is another important risk factor in the development of Oral SCC however the synergistic effect of alcohol and tobacco consumption is believed to play a greater role than either agent alone as alcohol inhibits DNA repair from cellular injury due to nitrosamines found in cigarette smoke and may also act as a solvent that facilitates the passage of carcinogens through cellular membranes.

As with recurrence there were no significant risk factors for predicting patient death at one year. At five we found a significant (P=0.035) relationship between death and tumour staging. In the literature, FOMSCC has a high risk of regional lymph node metastases with an adverse impact on prognosis. Patients with lymph node metastases are staged as Stage III or IV (Appendix 1).

The literature shows that lymph node metastases reduces survival rate.[11] Stage IV has been shown to have a 5-year survival rate of 23-58%, stage III 41-66%, stage II 59-80% and stage I 86-94%. Our survival rates were Stage IV 65%, Stage III 80%, Stage II 100% and Stage I 100%.[11]

We found that patients that had post-operative chemo-radiation had a slightly lower survival rate than those who did not receive it. This was not found to be statistically significant (P=0.36). This finding is in keeping with findings reported by Chang et al. and Ong et al.[8,22] It is however conflicting with other literature which shows that concurrent postoperative chemo-radiation improves survival rates.[25,26]

CONCLUSION

Oral SCC is a multifactorial disease with a wide range of presentations, staging and prognosis. From the study performed it appears that tumour staging as well as the use of alcohol appear to be significant variable in the risk of recurrence and five-year survival of patients.

Our findings suggest earlier diagnosis, and active treatment of early-stage disease may be the best means of improving 5-year survival rates. Efforts to improve quality of care and manage limited resources should concentrate on choosing the appropriate disease stage for surgical management, improve cancer surveillance and strengthen referral system so as to improve early detection of disease and provide social support and counselling for adjunctive habits such as alcohol and tobacco use cessation which will improve patient outcomes.

SUMMARY

- Survival rates for FOMSCC reduce with advancing stage.
- Advanced stage malignancies may require large composite resections with reconstructions. These procedures are resource intense.
- This study shows that the only significant predictors of survival was the stage at diagnosis, in keeping with international standards, and alcohol usage.
- Patients with advanced stage IVA disease should be more carefully selected for these procedures.

Compliance with Ethical Standards

Conflict of interest

The authors hereby declare that they have no conflict of interest.

Ethical standards

There was no human experimentation conducted in this study as it was a retrospective record review.

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APPENDIX 1

American Joint Committee on Cancer (AJCC) Tumour Staging 8th Edition by Site: ORAL CAVITY

PRIMARY TUMOUR (T)

TX Primary tumour cannot be assessed
T is Carcinoma in situ
T1 Tumour ≤ 2 cm, ≤ 5 mm depth of invasion (DOI)
T2 Tumour ≤ 2 cm, DOI > 5 mm and ≤ 10 mm; or tumour cm but ≤ 4 cm, and DOI ≤ 10 mm
T3 Tumour > 4 cm; or any tumour with DOI > 10 mm but ≤ 20 mm
T4 Moderately advanced or very advanced local disease
T4a Moderately advanced local disease:

Tumour invades adjacent structures (e.g. through cortical bone of the mandible or maxilla, or involves maxillary sinus or skin of the face) or extensive tumour with bilateral tongue involvement and/or DOI > 20 mm

Note: Superficial erosion of bone/tooth socket (alone) by a gingival primary is not sufficient to classify a tumour as T4.
T4b Very advanced local disease:
Tumour invades masticator space, pterygoid plates, or skull base and/or encases internal carotid artery

REGIONAL LYMPH NODES (N)

NX Regional lymph nodes cannot be assessed N0 No regional nodes metastasis
N1 Metastasis in a single ipsilateral lymph node, 3 cm or less in greatest dimension
N2a Metastasis in a single ipsilateral lymph node, more than 3 cm but not more than 6 cm in greatest dimension

TNM Staging, Oral Cavity			
Stage 0	Tis	N0	M0
Stage I	T1	N0	M0
Stage II	T2	N0	M0
Stage III	T3	N0	M0
	T1	N1	M0
	T2	N1	M0
	T3	N1	M0
Stage IVA	T4a	N0	M0
	T4a	N1	M0
	T1	N2	M0
	T2	N2	M0
	T3	N2	M0
	T4a	N2	M0
Stage IVB	Any T	N3	M
	T4b	Any N	M0
Stage IVC	Any T	Any N	M1

N2b Metastasis in multiple ipsilateral lymph nodes, none more than 6 cm in greatest dimension
N2c Metastasis in bilateral or contralateral lymph nodes, none more than 6 cm in greatest dimension
N3a Metastasis in a lymph node more than 6 cm in greatest dimension
N3b Metastases in any node with clinically overt extra nodal extension

DISTANT METASTASIS (M)

MX Distant metastasis cannot be assessed
M0 No distant metastasis
M1 Distant metastasis

http://dx.doi.org/10.17159/2519-0105/2021/v76no9a5

Alveolar bone resorption following tooth extraction characteristically illustrated

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ABSTRACT

Under normal physiological conditions, bone undergoes a constant, balanced and well- regulated process of renewal and remodelling. This is needed for growth, remodelling and maintenance of skeletal form, as well as for homeostasis of skeletal and plasma calcium levels. The alveolar bone grows along with tooth eruption, and thereafter its shape and volume are influenced by local mechanical as well as systemic factors. It is maintained by forces exerted on it via the periodontal ligaments, thus teeth are mandatory for its preservation and renewal. Following tooth loss, the socket becomes filled with a blood coagulum, which is later replaced by fibrous tissue. This healing process is associated with sizeable reduction in ridge height within the first two months that continues at a slower and variable rate throughout life. There are countless examples of patients who have lost teeth at an early age, presenting with severe alveolar bone loss bone in that area / jaw. The extent is even more dramatic if the edentulous space has been opposed by natural teeth. The cases illustrated in this paper serve to remind clinicians of the need to help patients maintain as many of their natural teeth as possible, while still being cognisant of their aesthetic and functional demands, and the possible health implications.

INTRODUCTION

Bone is a dynamic tissue that undergoes constant renewal and remodelling in response to local mechanical, nutritional, functional and hormonal influences.[1,2] Under normal physiological conditions there is a constant and well-regulated balance between bone formation by osteoblast and osteocytes, and bone resorption by osteoclasts.[1] This process is needed for both the growth, remodelling and maintenance of skeletal form and structure as well as for homeostasis of skeletal and plasma calcium levels[3]. Disturbances in any of the influencing factors will have a concurrent effect on bone quality and / or quantity.

Literature review

As early, as 1881 Roux postulated that loss of alveolar bone following tooth loss was an example of disuse atrophy. He believed that if "the forces on the bone were reduced, the body would need less bone and so would automatically get rid of that which was not being used"[2]. Glickman (1948) took a more holistic approach and did not consider the bone in isolation but rather as part of a functioning unit. He proposed that "the status of bone equilibrium is variable, dependant on the physiologic and pathologic process of the entire body for its regulation"[4]. This led others to also consider that bone loss may be multifactorial. Sobolik (1960) suggested, "The status of bone equilibrium was under the influence of the physiological and pathological processes of the entire body". As such, the

Figure 1. A panoramic radiograph and B. Intraoral view of a patient with severe ridge resorption following tooth loss

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The role played and the respective contribution:
1. **Leanne M Sykes:** Primary author 60%
2. **C Bradfield:** 20%
3. **K Naidu:** 20%

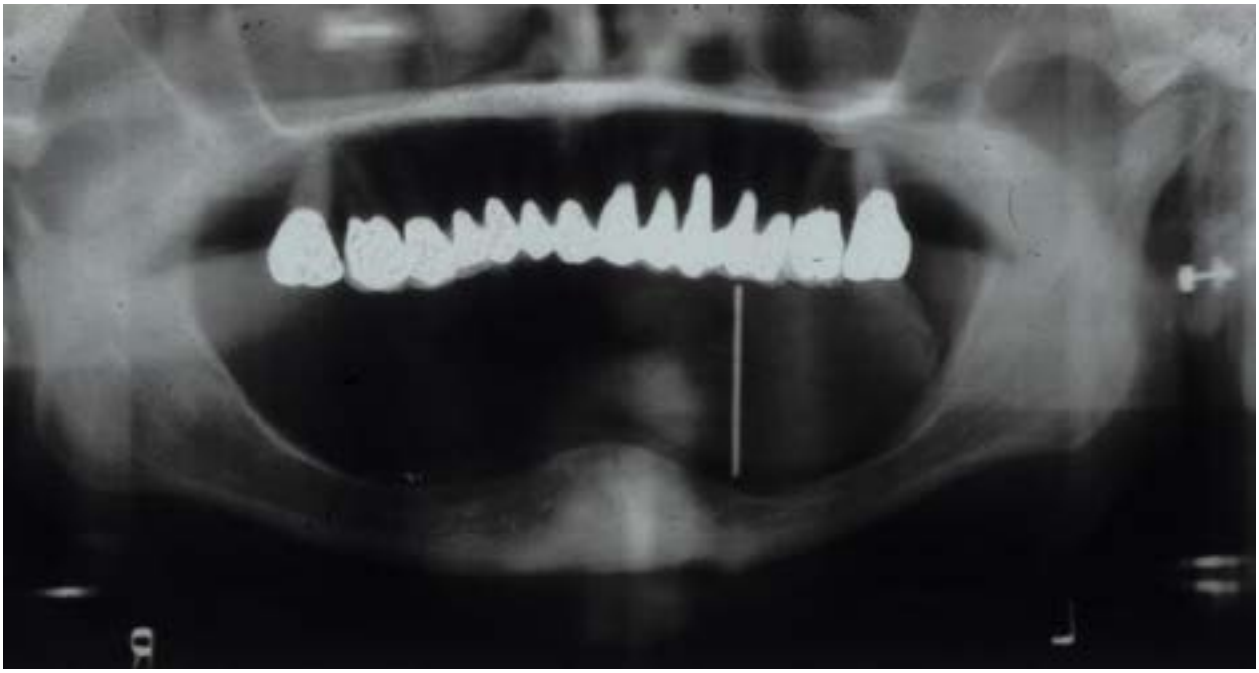

Figure 2. Mandibular ridge resorption in an edentulous mandible opposed by a long span maxillary fixed prosthesis (of questionable structure)

Figure 3. Severe mandibular ridge resorption in an edentulous mandible opposed by a long span maxillary fixed prosthesis

amount of resorption after tooth loss would depend on both local factors such as the extent of infection and type of surgical techniques used, as well as systemic factors such as disease, metabolic disturbances and dietary deficiencies[5]. Others used engineering principles to argue how bone adapted in mass and structure according to mechanical demands and that any loading of the bone would result in stress and strain forces being exerted on it. Depending on the direction of the load these forces could be tensile or compressive resulting in either positive or negative strains, and associated bone deposition or resorption respectively[2]. This argument was explained by Qin et al (1998) who postulated that when a tooth was loaded there would be pressures exerted on it causing mechanical stimulation and strains on it as well as in the bone immediately adjacent to it and in more distant teeth. This along with masticatory muscle actions and reactionary forces in the temporomandibular joints would cause bending of the mandible and result in a steady-state condition of stress and strain that was needed to maintain bone mass[6]. It would then follow that bone resorption was a natural consequence of tooth loss that would result in reduction of the horizontal and vertical dimensions of alveolar bone, and that this process may continue for an unknown and indeterminable time[2]. (Figure 1)

These simplistic philosophies of “use it or lose it” seemed logical and could be justified with many examples of severe bone loss that are seen clinically in patients who have lost teeth at a young age. The bone devastation is even more dramatic

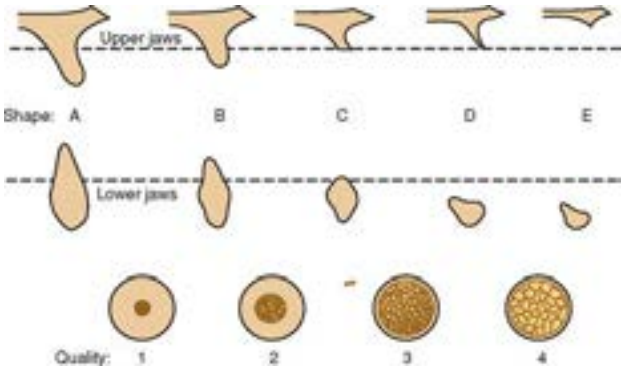

Figure 4. Lekholm and Zarb proposed classification of residual jaw shape and rates of bone resorption following tooth extraction, and bone quality.[14]

where the tooth loss is in one arch and the edentulous ridge has been subject to masticatory forces from natural teeth in the opposing arch (Figures 2 and 3)

The understanding behind the various processes involved in bone turnover and alveolar bone resorption have long since been replaced by a deeper insight into bone cell biology, the physiological, biochemical and cellular mechanisms involved in bone turnover and remodelling, and the pathophysiological factors at play during bone destruction.

Bone cell biology

This paper will present a brief review of bone homeostasis and the cellular mechanism behind remodelling in order to augment the case illustrations. It will not delve into the complex immunopathogenesis of pathological bone loss, particularly during periodontal disease or because of systemic disturbances. There are many excellent and detailed articles dealing with the host and microbial factors responsible for the disease process should colleagues be interested in reading further.

The alveolar process is that part of the mandible and maxilla that surrounds and supports the teeth. It consists of an outer layer of compact cortical bone surrounding an inner layer of trabecular bone. This architecture provides it with both rigidity and low weight [7]. The alveolar bone forms part of the periodontium, along with the gingiva, periodontal ligament, and root cement. The "ligaments join the cementum to the bone and are responsible for the mobility of the teeth, and for distributing and resorbing masticatory forces"[7]. Bone is a cellular and richly vascularized, "dynamic, active tissue undergoing constant renewal in response to mechanical, nutritional, hormonal, and concentration of circulating calcium influences."[1,7]. Under normal physiological conditions, formation and resorption are ongoing processes. The bone quality and quantity are determined by the interactions between the osteocytic and bone lining cells regulation, together with osteoblastic formation and osteoclastic resorption. In health, there is a constant and fine balance between these processes which ensures skeletal growth and maintenance, as well as homeostasis and regulation of bone and serum calcium levels[1]. The remodelling cycle is an "ongoing process which occurs throughout the skeleton in focal units called bone remodelling units (BMUs)"[1]. It is estimated that there are over 1 million of these units actively engaged in bone turnover at any given time[7]. During bone modelling, "the bones are shaped or reshaped by osteoclasts and osteoblasts working independently, while during remodelling, they are coupled". The two processes occur simultaneously throughout life to ensures that the strength of the skeleton is maintained, to repair small stress fractures, and to allow the body to adapt to functional loading[8].

Bone cells

"Preosteoblasts, osteoblasts, osteocytes and bone lining cells all arise from primitive mesenchymal cells in bone marrow stroma, while the pericytes arise from connective tissue blood vessels"[1].

Osteoblasts primary role is bone formation, but they also express factors that influence the environmental response to osteoclasts resulting in "localisation, induction, stimulation, inhibition and resorption". Osteoblasts are also responsible for producing proteases that dissolve the nonmineralised osteoid that covers the mineralised bone matrix. This must occur

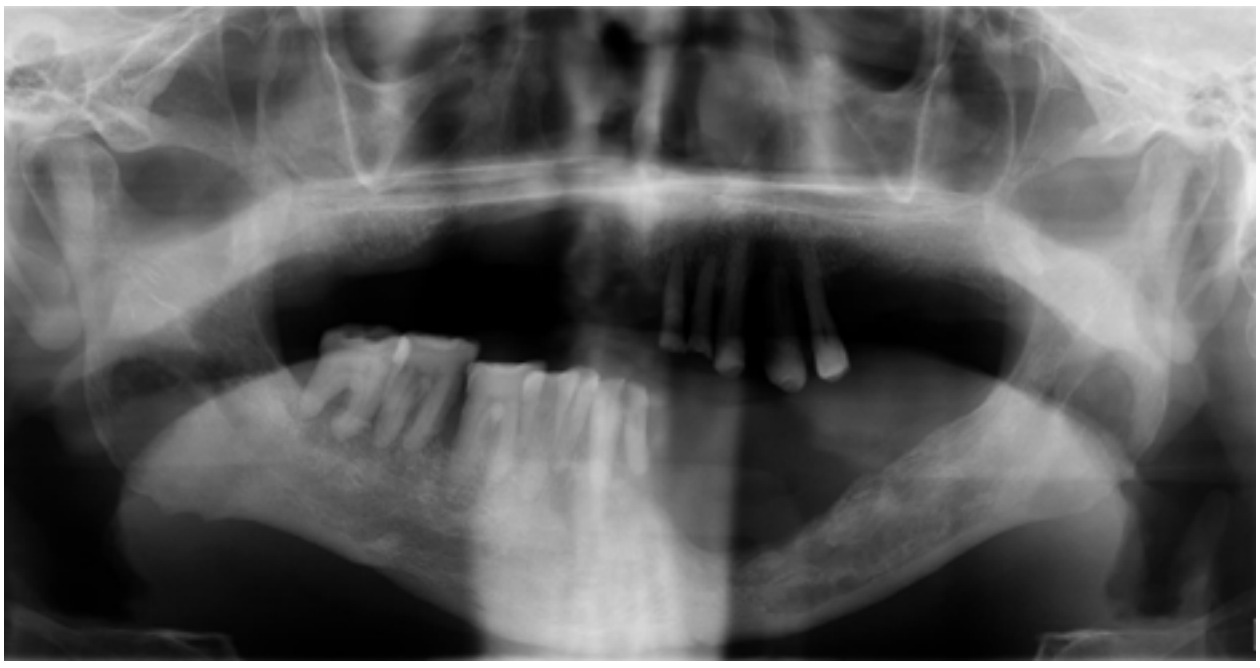

Figure 5. Bone preservation in dentate areas and severe resorption in edentulous areas

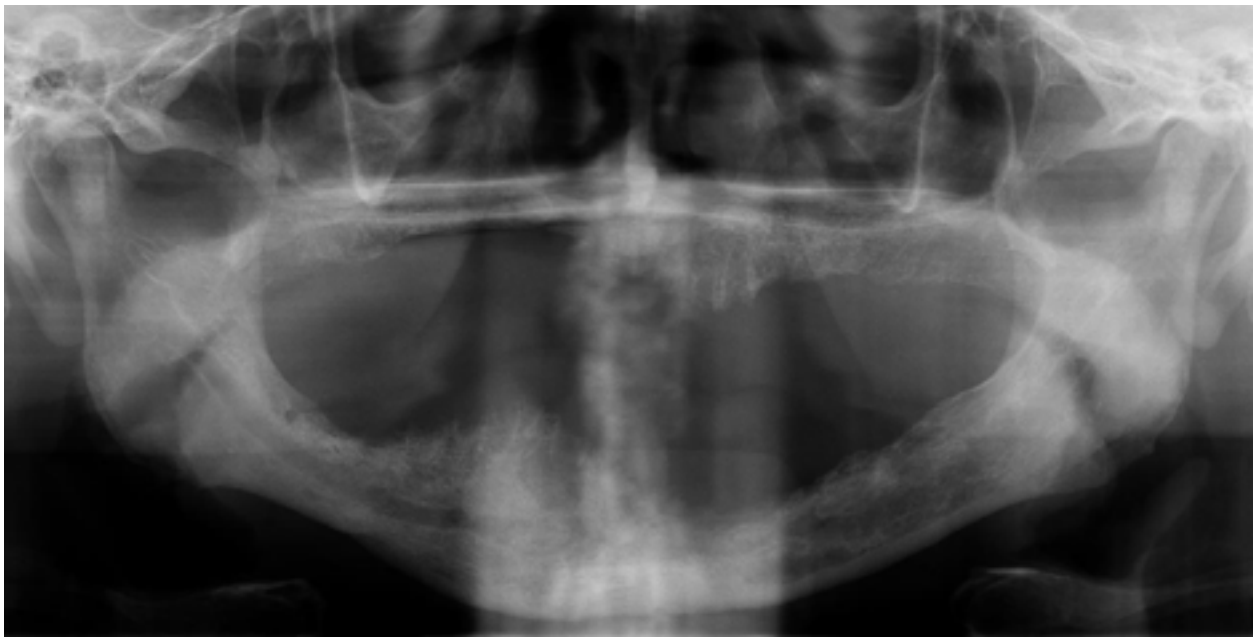

Figure 6. Unevenly resorbed ridges

before the osteoclasts can attach and initiate resorption[9]. Osteocytes are "mature bone cells within the bone matrix and are responsible for mobilisation of calcium from the matrix" if there is a systemic demand for this.[1]

Bone lining cells are multifunctional and play a role in "regulating the ionic composition of bone fluid, protecting surface bone from osteoclastic activity and regulation of new bone formation or resorption"[1]. Osteoclasts are derived from haematopoietic stem cells, and are "specialised into motile, migratory bone resorbing cells". Their function is degradation of mineralised bone and thus play a lifelong role in "normal skeletal growth, development and maintenance, as well as calcium metabolism".

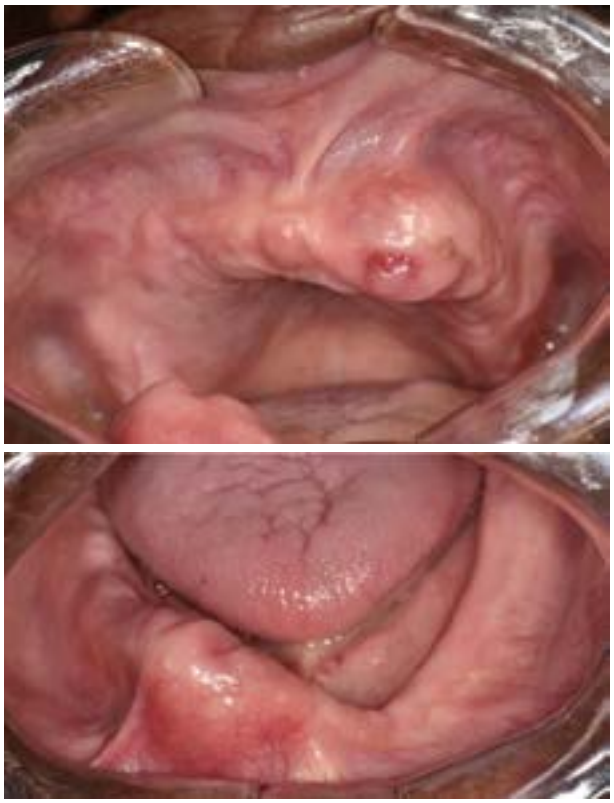

Figure 7 and 8. Difficult anatomical foundation for denture construction

Once attached to the mineralised matrix their cytoskeleton becomes reorganised and they form a sealing zone which isolates the resorption site. They also develop a ruffled border which secretes protease enzymes allowing them to remove both the mineral and organic components of the bone matrix[9]. The "rate of bone resorption can be regulated at the level of differentiation of osteoclasts from their precursor cells, or through the regulation of key functional proteins which control their attachment, migration and resorptive activities" [9,10]. Bone resorption is "also regulated locally by ionized calcium which is generated during osteoclastic resorption"[11]. The process of bone resorption is followed by a short reversal phase, which marks the transition from destruction to repair. During this time, there is simultaneous resorption and formation. Thereafter bone formation commences and takes place in two stages. There is an initial deposition of osteoid (primarily type I collagen), followed by calcification and mineralisation (primarily hydroxy-apatite)[12]. This process is largely mediated by non collagenous bone matrix proteins, which also play a role in cellular adhesion and the regulation of formation and resorption.

Alveolar bone mechanics and tooth loss

The alveolar bone grows "at a speed concomitant with that of tooth eruption" during the post-eruption phase, due to the forces exerted on it via the periodontal ligaments[13]. "It's volume is determined by tooth shape, inclination and tooth axis during eruption"[13]. Thereafter turnover is influenced by local mechanical as well as systemic factors. In the mandible, the rate is almost twice that of the maxilla. This has been explained by the fact that the mandible is only attached distally to the rest of the skull. This permits it to function as a "cantilever", but also allows for "deformation in the midline in three directions during jaw movements", as well as "at the side regions due to muscular contractions during jaw opening and protrusion"[8]. Teeth are mandatory for the maintenance of alveolar bone. Following tooth loss the socket becomes filled with a blood coagulum which is later replaced by fibrous connective tissue[8]. The healing process then commences and is associated

Figure 9. Difficult anatomical foundation for denture construction

with about a 50% reduction in ridge height within the first two months (however there is great individual variation)[8]. In the first 7-year period the rate of bone loss is almost four times greater in the mandible than the maxilla due to the far smaller load bearing area and distortion of the former as mentioned above[8]. This has been well illustrated by Lekholm and Zarb in their proposed classifications of residual ridge shape and bone quality (Figure 4)[14].

In figures A) most of the ridge is still present; B) moderate resorption has occurred; C) advanced resorption and only basal bone remaining; D) some basal bone resorption; E) extreme basal bone resorption. The bone quality depicted in 1) is mostly compact bone; 2) thick compact bone surrounding a core of dense trabecular bone; 3) thin layer of cortical bone surrounding a core of dense trabecular bone; 4) thin layer of cortical bone surrounding a core of low density trabecular bone.

Patient case illustration

A 74-year-old male patient presented with teeth 21 to 25 in the maxilla and 41 to 48 in the mandible. He reported that the rest of his teeth had been extracted intermittently over the past 20 years or more. The remaining teeth all exhibited class III mobility and were clinically over erupted and splayed. The panoramic radiograph showed severe bone loss around all of the teeth (Figure 4). It also illustrated the classical picture described in this paper of alveolar bone preservation in the quadrants where his teeth had been retained, and the severe resorption in the edentulous areas. This is particularly extensive in the posterior first quadrant and the anterior third quadrant where the edentulous areas had been subject to the masticatory forces of the opposing teeth.

All teeth were deemed unsaveable and subsequently extracted. Note how this has resulted in the most unfavourable ridge conformation (Figure 5). This will be a challenge for denture construction (Figures 6 and 7) and result in poor aesthetics due to the underlying alveolar ridge anatomy (Figure 8). It is however a classical illustration of Alveolar bone resorption following tooth extraction

CONCLUSION

With the advent of implant therapy, it has become all too easy and tempting for practitioners to extract questionable teeth and promise the patients replacement with implants. However, this treatment modality is not economically accessible to the majority of South African patients. In addition, it may not be possible due to confounding local or systemic factors. Dentists should still strive to adhere to the long held ethical standard of “first do no harm”. They need to develop a holistic approach to treatment planning and help patients maintain as many of their natural teeth as possible, while still being cognisant of their aesthetic and functional demands and possible health implications.

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A Review of the South African National Oral Health Policy

SADJ October 2021, Vol. 76 No. 9 p551 - p557

Dr NA Mukhari-Baloyi[1], Prof A Bhayat[2], Prof TK Madiba[3], Dr NR Nkambule[4]

ABSTRACT

Introduction

Advocacy for oral health promotion, prevention and treatment of oral diseases is founded on a comprehensive oral health policy that is integrated into the South African National Health Policy. The policy is intended to be a roadmap in the pursuit of achieving optimum oral health for the South African population.

Aim

To review the National Oral Health Policy of SA (NOHPSA) in terms of context, strengths, weaknesses, implementation and monitoring regarding the oral health status of the South African population.

Results

Promotive and preventive services lack detail on activities to achieve goals. The objectives, although very well defined, cannot be measured and there is no way of knowing whether they have been achieved. It was evident that the policy needs to be reviewed and updated in accordance to recent survey data, population growth and the profile (number and types) of health service providers. The prospect of updating the policy relies on the availability of current epidemiological surveys, which are not available, the most recent survey was conducted in 2002.

Conclusion

The policy lacks a monitoring and evaluation plan. This is critical not only for the assessment of actualisation of aims and objectives, but for the sustainability of intended interventions.

Keywords

Oral health policy, national health policy

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The role played and the respective contribution:

1. **Dr Ntsakisi A. Mukhari-Baloyi:** 40%
2. **Prof Ahmed Bhayat:** 20%
3. **Prof Thomas K. Madiba:** 20%
4. **Dr Ntombizodwa R. Nkambule:** 20%

INTRODUCTION

The review of policies in health is important to determine their relevance and applicability over time and to determine whether the aims and goals are still being met. A review thus informs the recommendation for changes to improve the effectiveness and give clarity to indicators for desired outcomes. A thorough review requires an analysis of the implementation, monitoring and evaluation phases of the policy making process; this ensures that the final phase which is the maintenance, succession or termination of the policy can be decided on.

Oral health policies, like other health policies, are essential in any country as they provide direction as to where the current health status is, where they want to move it toward and the resources that will be required to get to their desired destination. Studies have shown that countries without any clear oral health policy, like Russia, tend to have a higher prevalence of oral disease in comparison to other countries with similar socio economic standings.[1] This could be attributed to the fact that if there is a need to improve the health of any nation, there must be clear goals, a clear direction and a destination with time lines to ensure that all stakeholders, NGOs, and funding agencies can monitor the progress of the countries health at any given time.[2]

Oral health policies of SA, China and Brazil, countries with a similar economic rating, as they fall under the BRICS umbrella (Brazil, Russia, India, China and South Africa); are very similar in context but they vary significantly in their implementation, monitoring and evaluation.[3-7] These countries' policies are all based on their respective National Health policies.[8-12]

The National Oral Health Policy of South Africa (NOHPSA) was formulated based on the National Health Policy of 1990.[8] The policy is founded on two broad pillars; the goals that need to be achieved for oral health in SA and the targets that need to be met in terms of treating and preventing oral health diseases, as shown below (Figure 1).

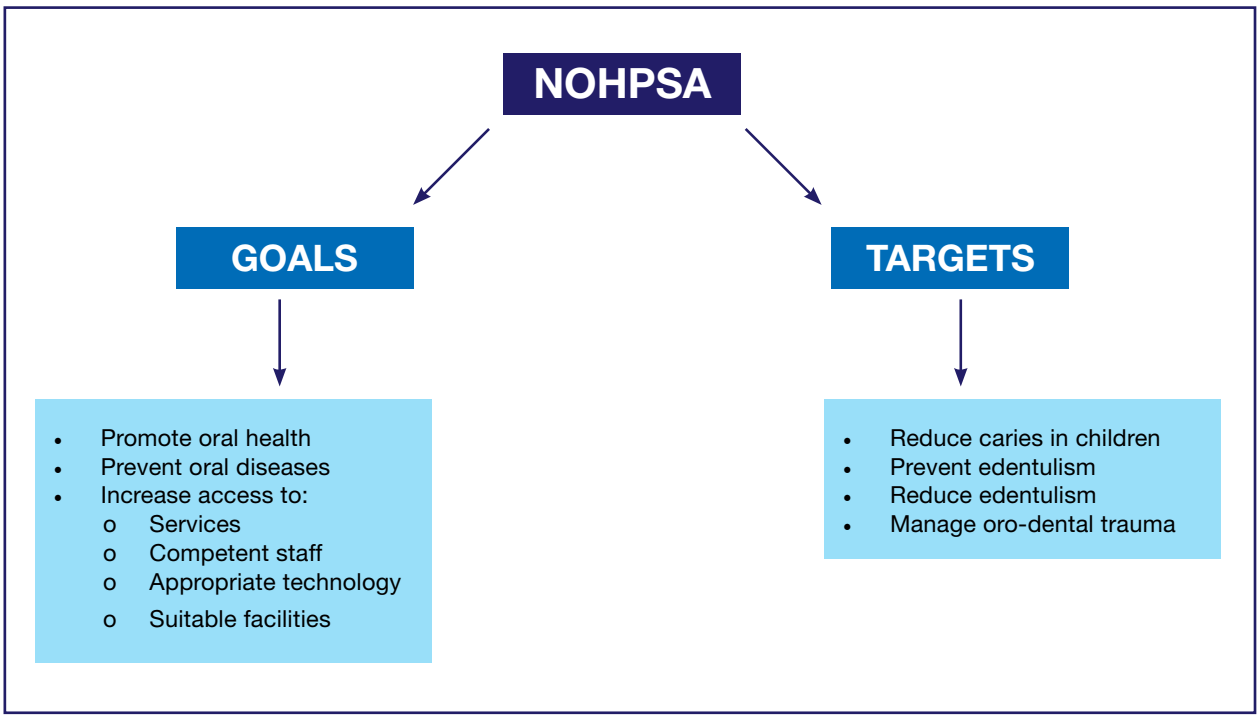

Figure 1. Diagrammatic representation of the goals and targets of the NOHPSA

Goals

The goals of the NOHPSA are to promote oral health and prevent diseases thus ensure good oral health; based on the elements of the primary health care approach. It is directed at all citizens of South Africa (SA) including service providers such as oral and general health workers, and the government oral health directorate. The goals also strive to ensure that all people have access to quality oral health care at affordable rates and that oral health services are provided by competent clinicians, using up to date technology in facilities that are safe.[8]

The promotion of oral health entails education and preventive services at the primary health care level and includes schools. These are the services that are rendered at schools, and form part of the Integrated School Health Programmes (ISHPs) through partnerships with academic institutions, Department of Health and private oral health companies.

The prevention of oral disease requires screening for early detection and management. This includes the prevention of progression and management of diagnosed diseases. This requires a well-structured referral system for patients to be treated.

The objectives that were included in the NOHPSA were based on previous studies that were relevant at the time during which the policy was developed. However, with time these targets need to be amended and modified to be relevant and in line with the current disease burdens. In order to determine whether the targets, in any policy are relevant, it is important to carry out surveys carry out surveys that will measure the disease burden and the impact of services rendered. The most recent oral health survey of South Africa was focused on children, and it was conducted between 1999 and 2002. During that period 60.3 % of children under age 6 presented with caries and 80% of that cohort had untreated caries.[13]

This implies that there is a high prevalence of dental caries among children and that the vast majority of these children do not have access to dental care. Since then, there has been no other National surveys conducted to gauge whether this has changed or not.

Thus the oral health strategy that is currently the operational basis of oral health programmes in the country needs to be reviewed in order to identify weaknesses and improve on them so that when a new policy is developed, it can be more appropriate and relevant to the South African context.

AIM

The aim of this study was to review the National Oral Health Policy of SA (NOHPSA) in terms of the context, strengths, weaknesses, implementation and monitoring with regards to the oral health status of the South African population.

METHODS

This review was conducted using aspects of the conceptual framework developed by Singh et al. (2010) which was specifically designed for the analysis of oral health promotion in health policies.[3]

Their frame was adapted from the advocacy coalition frameworks. Using it as a guide one understands that to analyse an oral health policy one must understand the political and health transformations of the country, in so doing also be cognisant of the possibility of unexpected changes to that landscape, while taking into consideration the healthcare belief systems of the stakeholder who are affected.

The objectives of the policy were analysed based on the SMART criteria.[4] These criteria ensure that the goals are

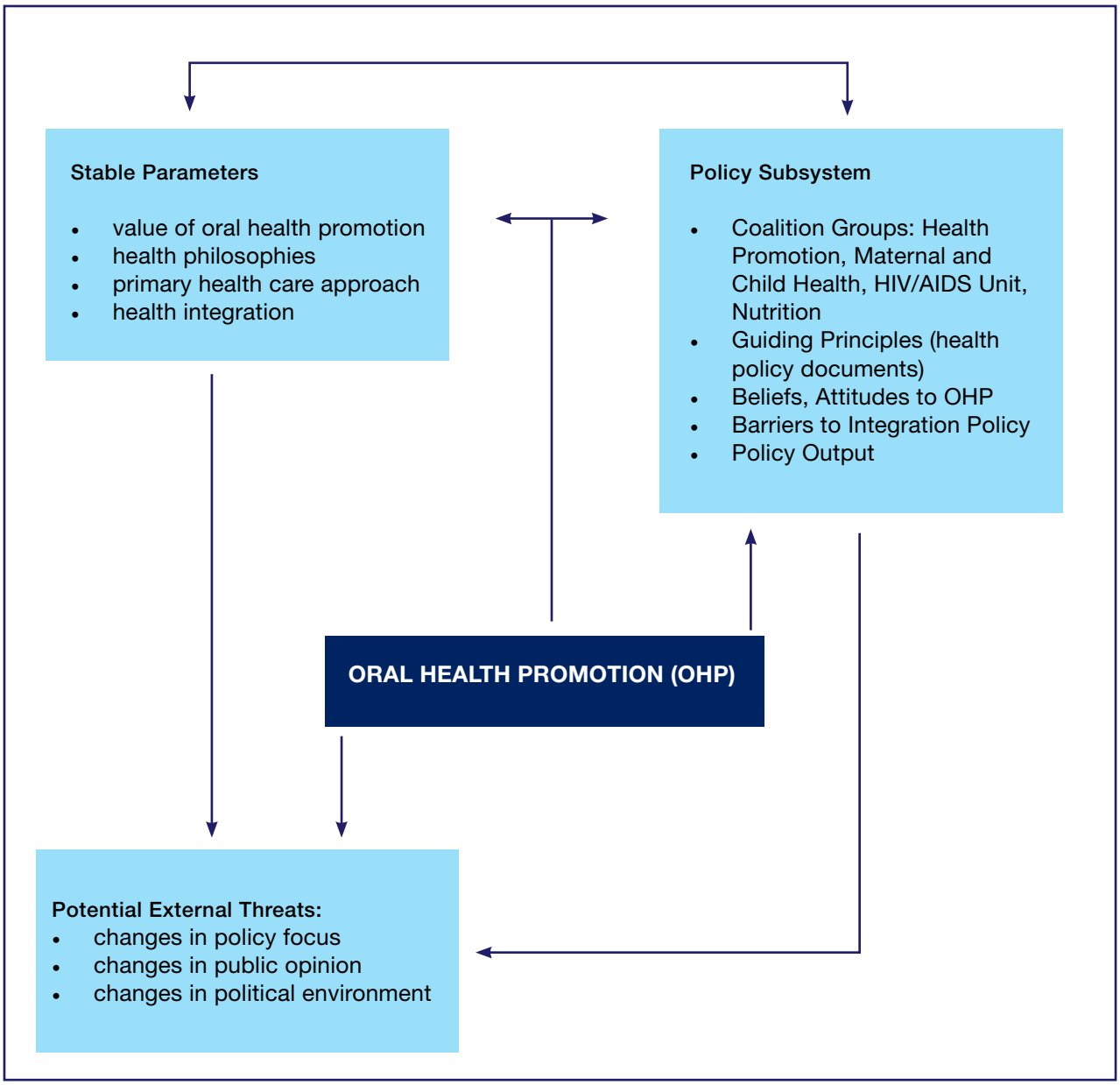

Figure 2. Adapted conceptual frame work[3]

Specific, Measurable, Relevant and Timely. It is a thorough analysis of the policy document pertaining to context, implementation and monitoring.

RESULTS

The education and preventive services places emphasis on the fluoridation of water for communities as a pivotal preventive programme. However, to date no province or district has introduced a water fluoridation program. Other preventative services that should be implemented are unfortunately not defined, however, there are fissure sealants and brushing programmes being conducted throughout the country under the auspices of the department of oral health.[15-16]

The curative services are defined with a focus on prioritisation of the waiting list system. Levels of treatment are set within the scope of practice of oral health professionals and include education, preventive and curative services (management of pain and sepsis set as priority). There is a defined recommendation of the oral health workforce allocation in the form of ratios of oral health professionals per number of people in the country. Regarding dental specialists, however there is no mention of any dental specialists except that of Community Dentistry. The policy defines the scope of the Community Dentist specialist as being confined to non-clinical work including policy development and screening.

The fee structure for these services in the public sector is clearly defined. It is evident that there is a range of free dental services within the lower levels of care and tariffs will be set for higher levels of care. The levels of care are clearly stipulated, from self-care, primary, secondary and tertiary care. All dental services are free at PHC facilities but there is a user fee at secondary and tertiary hospitals for all dental care. The policy differentiates two main areas in the delivery of services; organised services, which are free to stipulated categories, and non-organised services. The organised services are clearly defined as preventive,

educative and emergency services for children at centres of learning from pre-school through to high school, at schools and at clinics. These include services at state institutions, hospitals and prisons.

Non-organised services include outpatient services, such as restorations, prosthodontic, orthodontic treatment and other elective treatments that are not inclusive of relief of pain, sepsis and trauma.

The objectives in the policy as a target for the year 2000, have included all age cohorts benchmarked on the South African Statistics from the 1980's in line with global oral health promotion standards.[3]

1. 1-6 year old cohort aimed at 50 % caries free by 2000.
2. 12 year old cohort must have DMFT of 1.5 or less.
3. 20 year old cohort must have a 60% tooth retention and have at least 35% increased periodontal health.
4. 35-44 year old cohort must have a reduction in the level of edentulism by 6.22% and ensure at least 15% are healthy.
5. 60-64 year old cohort must reduce edentulism by 21.41% and reduce deep periodontal lesions.

The implementation plan is not well structured and does not have clear guidelines. There is no monitoring and evaluation plan.

DISCUSSION

The policy details goals and targets that are aimed at promoting oral health and thus ensuring that the country benefits from services tailored for that purpose.

However, the policy is focused on addressing the oral health problems but does not include the effects of comorbidities (diabetes, HIV/AIDS etc), lifestyle choices (smoking, alcohol drug abuse) and other determinants of health (socioeconomic factors, malnutrition and trauma) that may predispose individuals to oral diseases.[17-21] Nor does it mention a collaborative prevention and oral health promotion with the medical professionals. The policy mentions collaboration with South African Medical Services only with reference to data collection. Other medical professionals such as paediatricians, speech and hearing therapists, pharmacists, medical doctors, etc. could play a vital role in the prevention and education related to oral diseases.[22-24] There is no mention of a private public partnership, nor the role of the private sector in provision of oral health care in the country.

Promotive and preventive services

The education and preventive services are not detailed enough. The water fluoridation rhetoric is redundant as SA has not implemented water fluoridation and some areas that use borehole water have water with fluoride at levels of 25 ppm[25] which is way over the recommended dose of 1ppm. There are a lot of controversial views pertaining to fluoridation of water and particularly on the African continent[26]. Other feasible means of delivery of fluoride should be explored such as toothpaste. There is also no mention of interdisciplinary collaboration with nurses, family medicine practitioners, dieticians etc, in relation to oral health promotion.

Free services at point of contact especially at primary health care level increase accessibility to services and draws closer to reducing the health inequalities experienced in the country.[27-28] With a user fee being charged at higher levels of care, an appropriate referral system would ensure that patients do not incur costs for treatment they may have not needed but wanted. In the policy it is stated that to gain access to secondary and tertiary oral health care, one must be referred via the hierarchy. As it is currently, all levels are accessible without referral, which is contrary to what is stated.[29] Adhering to the policy in this regard would aid in reducing the burden of demand at secondary and tertiary public health facilities, significantly reduce waiting times and may lead to saving on operational costs.[29] Access to appropriate oral health services should be emphasised on with the consideration of where people live and their socio-economic statuses, such that rural settings are far off the standard and quality of urban settings. Appropriate technology should make it possible to bridge the gap between the two settings, thus achieving equitable access[30] thus ensuring that every individual receives services that they need when they need them.

Provision of Oral Health Services

This section deals with the different types of services and categories of oral health providers. The services are divided into two categories, organised and non organised services. Organised services stipulates a clear mandate to cater for young children without description of exact services. The authors recommend that fissure sealants be included in the policy as one of the services rendered to the school learners as per other studies.[11,31-32] The non-organised services are vaguely described as outpatients with pain, sepsis and trauma. Clarity is needed as to whether this is within general health or dental clinics. It should be specified at which level of care the outpatients' services will be provided. Currently, these services are being provided at dental clinics at primary, secondary and tertiary facilities.

In order to achieve efficient curative services, a sufficient workforce per population is required and currently studies have shown that there is a shortage of human resources in oral health.[33] The personnel norms as stipulated in the policy definitely need to be revised and reviewed as they are outdated. Both the population and the workforce has increased considerably since the 1990's.[33] Therefore an audit of the population and human resources need to be done to determine the type and number of human personnel that need to be trained. The HRH strategy for 2030 indicates there may be surplus of dentists and a shortage of dental therapists whose scope is better aligned for the PHC package.[34]

The policy stipulates that Community Dentistry specialist's scope should be confined to non-clinical duties. It is not clear in the policy why that statement stands as there is no supporting evidence to it, their scope of practice is not stated as such. The assumption is that it may be owing to the fact that as of 2015 there were only 36 Community Dentistry Specialists available for service at the ratio of 1:1 636 424,[33] therefore at the time the draft was made the numbers were even smaller. Hence the policy makers saw it fit to limit the Community Dentistry scope of practice to non-clinal duties. However, it is essential for Community dentistry specialists to be involved in research, screening

of patients, treating patients where necessary and providing insight and knowledge on planning future policies. Ideally they should also inform oral health strategies and see to the monitoring and evaluation of implemented programmes.[35]

Mention must also be made of the role of other specialists including dental practitioners, oral hygienists and dental therapists and their numbers required to ensure the oral health targets can be achieved with adequate human resources.

Infrastructure and resources

Physical facilities, equipment, instruments and consumable supplies are mentioned to be procured through tenders. Emphasis should be placed on assuring that these resources are equitably distributed. The information is not detailed enough for any individual in the oral health care workforce to be able to initiate or follow up on procuring of items for clinics. The NOHPSA makes mention of accommodation needs and planning for oral health services in accordance with other policies, yet there is no detail as to which policies these are.

Objectives

Objective 1 was for 50% of the 6 year age group to be caries free by 2000, it has not yet been achieved. As of the most recent National Oral Health survey, only 30.7% of this population remained caries free by the year 2000.[13] The socio-economic status of the country renders many citizens categorised as underprivileged and under serviced. The quality of the diet is directly associated with socio-economic status.[5] Lack of oral health services and resources, lack of evidence of implementation of strategies for oral health education programmes and a multi-sectoral approach to prevention amplifies the problem of children not receiving quality oral health services.[6-7,9-12,36] Poor diet is linked to poor oral health, if this narrative remains the same it may be near impossible to reach the target aimed at reduction of caries in children. Even in light of the implementation of the National Health Insurance (NHI) Bill which aims to increase access to oral health services for all.

Objective 2 was to obtain a DMFT of 1.5 or less for the 12 year old group and this was achieved by 2004[13]. At the time that the objective was set, the figures were benchmarked against the National Oral Health survey of 1982 when the DMFT of the cohort was recorded at 2.5, by the next oral health survey that was published in 2004 it was at 1.1. This may be attributed to the improvement of school oral health programmes over the years.[37-38] There are no new surveys to confirm the current national prevalence.

Objective 3 was to ensure that at least 60% of 20 year olds retain all their teeth and at least 35% of them have a minimum of three healthy sextants. Surveys need to be conducted to measure the current oral health status among the 20 year olds.

Objective 4 mentions reduction of edentulism from 10.36% to 6.2%, to ensure that 80% retain at least 20 of their teeth and with respect to periodontal status, 15% have 3 healthy sextants.These targets are set in percentages but with no reference to the population size. It is difficult to assess whether this objective was achieved or not. The objective needs to be reviewed based on evidence and redefined in line with recent survey data.

Objective 5 is to reduce edentulism from 26.76% to 21.41%, ensure that 60% retain 20 teeth and reduce the mean number of deep pockets to 0.27. Similar to the fourth objective, these percentages were set without a population size reference. It must be taken into consideration that this age group often requires removable dental prostheses. This being attributed to the fact that the current services for adults are predominantly extractions due to a possible lack of infrastructure, materials and equipment.[11] Currently the state covers the costs of these prostheses for pensioners in order to restore function. Yet, there are few dentures being delivered in PHC clinic and in rural areas. However, the ideal would be for this status quo to be changed by ensuring that periodontal knowledge is emphasised in the oral health education programmes, and periodontal treatment initiated from the onset rather than at a later stage.

Objective 6 and 7 address the need to obtain and collate data on oral pathology and trauma related conditions. Various academic institutions are well underway with reporting and dissemination of publications pertaining to that. It would be beneficial for routine continuous professional development sessions to be conducted with private dentists and public dentists in this regard, for them to be encouraged to report their findings.

Re-engineering of primary health care services as set out in the NHI can ensure that each indicator is achieved by ensuring an equitable distribution of manpower to service each oral health facility and the funding to maintain the equipment. This would see to the reduction of the prevalence of edentulism by encouraging the provision of restorative procedures over extractions and changing the mindset of the population with regards to extractions versus restorations.[39-40]

Implementation

The implementation plan is vaguely structured, without a budget nor direct guidelines as to how to be implemented. It simply states the levels at which the policy should be implemented but not so much by which portfolios. All service providers of oral health are expected to implement this NOHPSA when rendering clinical services. All training and research facilities including the medical services and the private sector should develop and implement their own internal policies based on the NOHPSA.The NOHPSA should further aid in advocating for creating environments that are conducive to adoption of this policy, with training for appropriate management to oversee it. The fiscal aspects of the policy should be elaborated under implementation, as there will be a need to ensure that resources are allocated appropriately to achieve the objectives set in the main policy. The general public is privy to the contents of the policy, this will ensure improved utilisation and avoid misuse of oral health facilities. This will also ensure that oral health professionals do not abuse their authority when providing oral health care.

There is no mention on strategies to monitor and evaluate the policy. A review of the policy conducted in 2010, recognises the emphasis on equity, health promotion, integration and focus on the primary health care approach.[3] There is however little documented evidence on implementation of this policy, hence there is a need for the policy to be re-evaluated.

CONCLUSION

The policy context is in line with global oral health policies in that the aim is to provide universal oral health coverage for all with the end goal of enabling populations to take ownership of own oral health care.

The policy strengths lie on the following intentions:

- Training human resources to cope with demand
- Involve the community in planning
- Implementation based on evidence and thus tailor make programs to need
- Make oral health services accessible to all
- Make oral health services affordable to all
- Enable communities to practice self-care

However, there is no evidence of any of the intentions being translated into action. That poses as a significant weakness, along with the fact that oral health promotion is dominated by oral health professionals in a system that has a curative dominance over preventive care. Intersectoral collaboration with medical health disciplines to address oral health conditions could assist in changing that narrative.

The fact that there is no mention of monitoring and evaluation, implies that there is little effort to collate periodic data that each facility in the country is mandated to submit. The failure to collate data may also be attributed to lack of uniformity in terms of dental records within the country. It is thus impossible to review the implementation of the policy.

Overall, the policy was clear as to its outcomes but did not provide clear guidelines as to achieving these outcomes. This is inappropriate in a country like SA, where there is widespread disparity between provinces and even within provinces. The disease burden and demand differ across the country and as such a preventive measure which is effective in one community might not be in another. Therefore, the policy is not directive in nature and allows provinces and districts the leeway to adopt measures that will be suitable for their respective communities. However, the government of South Africa must be commended in drawing up such a policy which gives direction and a road map to where oral health should go. Many other countries do not have such a policy and hence the government has achieved a policy that is practical and implementable.

Recommendations

The policy framework is sound but needs critical emphasis on four areas, research, budget, multisectoral collaboration and a monitoring and evaluation plan.

It is not possible to set goals without relevant and up to date data. This hinges on oral health surveys that are conducted at local levels then collated in order to establish the prevalence of oral conditions and distribution of oral health personnel and facilities throughout the country.

Continuous professional development courses for all health care workers will ensure that they are well equipped with updated knowledge. Ensuring that if new technology is introduced for service rendering, staff members are able to incorporate it into the services, such that it does not become a futile expense. The facilities themselves should be well maintained to ensure that they are safe for the use of patients and staff.

An annual budget must be set for the intended goals, this would require for it to be defined at National and provincial levels. The allocation of funds should be done equitably amongst districts and provinces.

Take on a multisectoral approach to incorporate aspects of policies that influence oral health. Using the common risk factor approach to incorporate oral health into health policies. This can be achieved by providing lectures to allied health professionals during CPD meetings to educate them on oral health.

Establish a transparent monitoring and evaluation process for setting goals. This will allow for officials to take ownership of delegated responsibilities and also be accountable for its successes and failures. Not only will this ensure that policy objectives are are met but it may also act as a motivational tool for oral health teams involved.

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Resolution of a large periapical lesion in an immature maxillary lateral incisor with the aid of triple antibiotic paste

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N Potgieter,[1] GD Buchanan[2]

ABSTRACT

Introduction

Apexification procedures are frequently performed on immature permanent teeth with incomplete root formation, open apices and necrotic pulp status with or without periapical lesions in order to induce a calcific barrier prior to root canal therapy. The elimination and control of infection in the root canal space is critical to the success of these procedures.

Case Description

A healthy 21-year old male presented with pulpal necrosis, a large periapical lesion, incomplete root formation and an open apex on a maxillary right lateral incisor. Triple antibiotic paste was used to achieve antimicrobial control after traditional calcium hydroxide paste medicament failed to resolve the symptoms. Obturation was achieved using MTA and the conventional apexification technique. Excellent healing of the large periapical lesion was achieved without surgical intervention and the 4-year follow-up CBCT demonstrated complete bone fill of the lesion.

Conclusion

Clinicians should be aware that alternative antimicrobial medicaments, such as triple antibiotic paste, may be beneficial in situations where conventional medicaments prove unsuccessful. The use of triple antibiotic paste may result in sufficient healing of the periapical lesion to justify placement of an MTA apical barrier without the need for surgical intervention.

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The role played and the respective contribution:

1. **Nicoline Potgieter:** 50%
2. **Glynn Buchanan:** 50%

Keywords

apexification, endodontics, triple antibiotic paste, calcium hydroxide.

INTRODUCTION

Apexification is a term referring to endodontic procedures performed to achieve apical closure of immature permanent teeth presenting with incomplete root development, open apices and pulpal necrosis.[1]

Historically, apexification involved the placement of calcium hydroxide (CH) paste over multiple treatment appointments in order to create a calcific barrier in the apical area prior to the completion of root canal treatment.[2] Whilst this approach demonstrated clinical success, several disadvantages were reported with the technique, including: difficulty with patient follow-up, delayed treatment, risk of root fracture and unpredictability of the apical seal.[1] Additionally, placement of CH for extended periods has been demonstrated to weaken tooth structure.[3]

In modern endodontics, calcium silicate cements such as mineral trioxide aggregate (MTA) are recommended as the preferred material for use in apexification procedures due to their excellent sealing properties, biocompatibility[4] and antimicrobial activity.[5] The use of calcium silicate cements has additionally led to the ability to complete apexification procedures in a single visit.[6]

Whilst single-visit apexification approaches may be beneficial to both patients and practitioners in terms of decreased time and a reduced need for follow-up/patient compliance, great care must be taken to ensure that adequate disinfection of the root canal space is achieved prior to obturation. Triple antibiotic paste (TAP), first described by Sato et al.[7], is an effective antimicrobial agent, consisting of a mixture of ciprofloxacin, metronidazole and minocycline and has been successfully used in regenerative endodontic procedures for permanent teeth demonstrating pulpal necrosis.[8,9]

The following case reports the successful endodontic management of a maxillary lateral incisor with a large periapical lesion and open apex, where TAP was used for root canal disinfection after traditional CH paste failed to achieve adequate microbial control prior to obturation.

Figure 1. Pre-operative evaluation of the right maxillary lateral incisor: A) clinical image of suppurative swelling and B) peri-apical radiograph

Ethical approval for this case report was obtained from the Research Ethics Committee, Faculty of Health Sciences, University of Pretoria (Protocol number: 19/2021).

Case presentation

A healthy, 21-year old male presented to the University of Pretoria Oral Health Centre with acute suppurative swelling and pain in the right pre-maxillary area (Figure 1a). Radiographic examination confirmed an open apex and large periapical radiolucency associated with right maxillary lateral incisor (Figure 1b).

The tooth was anesthetized, isolated with a rubberdam and an emergency root canal treatment was performed for pain relief. Pus drainage was established through the canal and buccal soft tissue during copious irrigation with a saline solution. Digital pressure was applied to the buccal swelling to further express inflammatory exudates. Chlorhexidine (2% concentration) was chosen as the preferred irrigant, considering the absence of an apical stop and increased risk of sodium hypochlorite extrusion and injury. Calcium hydroxide paste (Calacept, Ultradent, South Jordan, USA) was placed as an intracanal medicament and the access cavity temporarily sealed with glass-ionomer cement, placed on clean dentine and enamel. (Fuji IX GP, GC Corporation, Tokyo, Japan).

The patient was referred for a small-volume cone-beam computed tomography (CBCT) scan. The scan revealed a periapical lesion with well-defined borders, ballooning appearance, radiolucent lumen, perforation of the cortical plate, size greater than 10mm in diameter and open apex of the right maxillary lateral incisor (Figure 2). Differential diagnosis included either a large periapical granuloma or radicular cyst. The initial treatment plan included apexification, obturation of the canal and - if required at a later stage - cystectomy or periapical surgery. The final diagnosis was to be confirmed by biopsy and histopathological evaluation.

At the subsequent follow-up visit, no swelling or drainage was clinically visible however the patient reported continued symptoms of discomfort. Following anaesthesia and rubber dam isolation, the canal was cleared of CH medicament and working length was determined by an apex locator (ProPex Pixi, Dentsply Sirona, Ballaigues, Switzerland) and confirmed with a radiograph. Negative pressure irrigation with 6% sodium hypochlorite (Chlor-Xtra, Vista Dental, Racine, USA) was performed using the Endovac irrigation system (Kerr Corp., California, USA) during instrumentation of the canal with a size #90 k-file. After instrumentation, 17 % ethylenediaminetetraacetic acid (EDTA, Vista Dental, Racine, USA) irrigation was used followed by a final rinse of NaOCl. When attempting to dry the canal with paper points, persistent clear fluid drainage was found.

A triple antibiotic paste (TAP), consisting of a mixture of metronidazole, ciprofloxacin and minocycline was mixed in a 1:1:1 ratio with propylene glycol as carrier and placed into the canal using a k-file and anticlockwise rotation. Precautions were taken to place the TAP beneath the level of the cemento-enamel junction to prevent subsequent tooth discoloration of the crown. The access cavity was temporarily sealed with glass-ionomer cement (Fuji IX GP, GC Corporation, Tokyo, Japan) placed on clean dentine and enamel.

The patient failed to return for follow-up visits in the subsequent months due to personal circumstances. Numerous attempts were made to contact the patient, motivating a return for follow-up and completion of the treatment. The patient finally returned after 2 years and 3 months. At this visit, the patient was asymptomatic and radiographic evaluation demonstrated sufficient healing of the periapical lesion around the maxillary right lateral incisor to justify placement of a Mineral Trioxide Aggregate (MTA) apical barrier (Figure 3A).

The remaining medicament was removed with 6% Sodium Hypochlorite (Chlor-Xtra, Vista Dental, Racine, USA) with the Endovac negative pressure irrigation system (Kerr Corp., California, USA). Working length was reconfirmed (Figure 3B), the canal was dried with paper points and the open apex closed by packing a 4 mm increment of MTA (ProRoot MTA; DentsplySirona, Charlotte, USA). After the MTA set, the remainder of the root canal was obturated with

Figure 2. A limited field-of-view CBCT confirming the absence of a natural apical constriction, severe bone loss and perforation of buccal cortical plate: A) Coronal view, B) Sagittal view, C) Axial view and D) three-dimensional reconstruction.

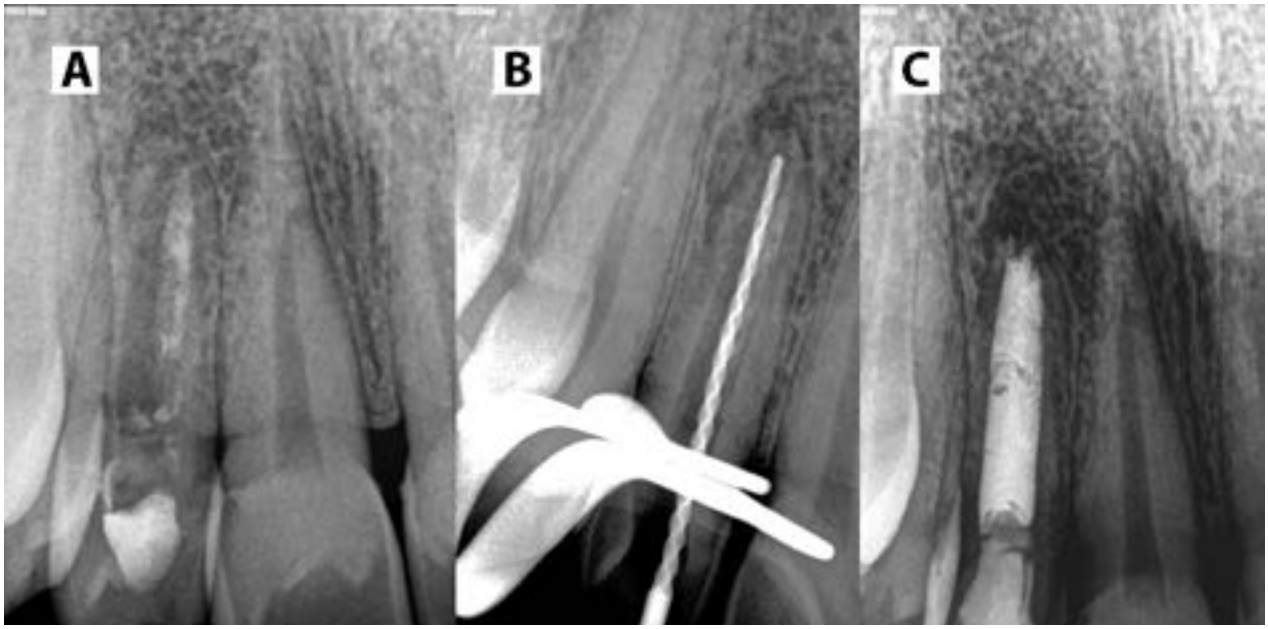

Figure 3. A) A two-year, follow-up periapical radiograph, revealing resolution of the periapical pathology B) working length confirmation with a large diameter k-file C) immediate post-operative periapical radiograph.

heated gutta-percha delivered from a VDW Beefill backfill unit (VDW GmbH, Munich, Germany) (Figure 3C). The gutta-percha was sealed at the orifice level with resin-modified glass ionomer (Vitrebond, 3M ESPE, St. Paul, USA) and the access cavity restored with Filtek Supreme composite (3M ESPE, Seefeld, Germany).

The patient was not committed to attend regular follow up visits, but was finally convinced to return for a follow-up evaluation. Four years after the initiation of the treatment, the patient was asymptomatic and the follow-up CBCT (Figure 4) showed bone fill around the right maxillary lateral incisor with complete healing of the buccal bone plate. The patient gave written consent for the use of the images and radiographs for publication.

Figure 4. A 4-Year follow-up CBCT showing resolution of the apical area with bone fill: A) Coronal view, B) Sagittal view, C) Axial view and D) three dimensional reconstruction.

DISCUSSION

When pulpal necrosis occurs in immature permanent teeth with open apices, treatment options may include either root-end closure via apexification or regenerative endodontic procedures.[1] Kim et al.[11] recommended that whilst either of the above-mentioned treatment approaches may be selected - teeth with near complete root formation (Stage 4 of Cvek's classification of root development,[10] Figure 5) - may be better suited for apexification using MTA-barrier techniques. Whilst regenerative endodontics has the potential to produce vital periodontal-like tissues in the root canal space and encourage continued root formation, the literature still lacks high-level evidence supporting this approach[12] with the majority of studies relying on case reports and case-series, and only a few randomized clinical trials with short-term follow-up.[11] Additionally, fewer appointments are required to complete apexification procedures as compared to regenerative endodontic procedures. In the present case, the tooth was classified as Stage 4 according to Cvek's classification of root development and following discussion and informed consent with the patient, MTA apexification was considered the treatment of choice.

Appropriate cleaning, shaping, disinfection and filling of the root canal system is essential to the success of all nonsurgical endodontic treatment.[13] Calcium hydroxide is commonly used as an intracanal medicament due to its bacteriostatic effects, due to the high pH value, and its ability to induce hard tissue formation.[3] Triple antibiotic paste has been demonstrated to effectively eliminate bacteria when used in a protocol termed lesion sterilisation and tissue repair therapy (LSTR).[7,14] When compared to CH, TAP has been reported to demonstrate superior antimicrobial activity.[15] For this reason, TAP may be selected as an alternative medicament in non-surgical endodontic cases where traditional CH paste fails to eliminate the symptoms.[16,17] The healing demonstrated in the present case following the application of TAP supports these findings.

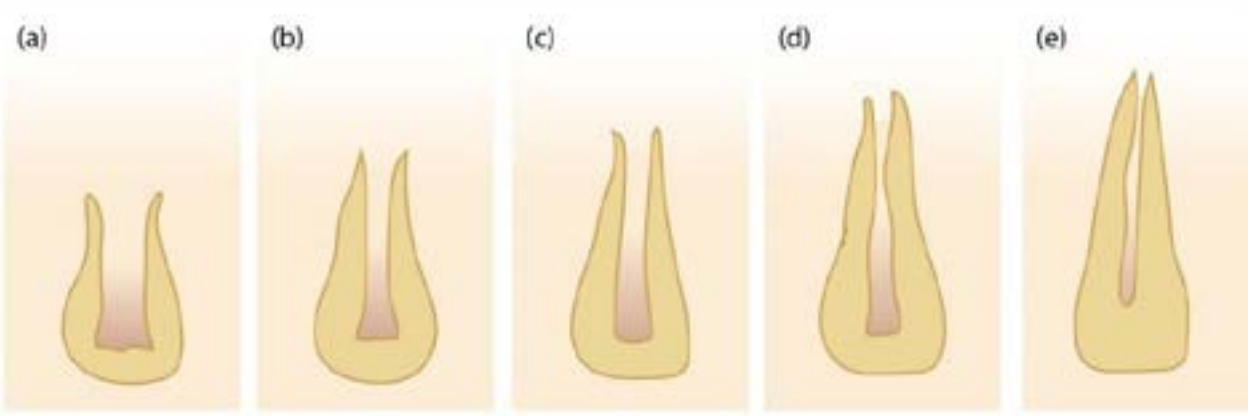

Figure 5. Cvek's classification of root development[10]

Crown discolouration may occur following apexification procedures due to either the minocycline present in TAP[9] or the bismuth oxide found in MTA.[4] In order to avoid this complication, some authors have suggested the use of Biodentine (Septodont, St. Maur-des-Fossés, France) instead of MTA, as this material does not contain bismuth oxide.[18] Crown discolouration is however a known complication when selecting these materials and this risk should be well-communicated to the patient prior to treatment.

The diagnosis of large periapical lesions as radicular cysts on radiography alone remains a clinical challenge.[19] Cone-beam computed tomography (CBCT) scanning has been proposed as a non-invasive method for differentiating between radicular cysts or periapical granulomas by measuring "grayscale value".[20] Rosenberg et al.[19] however reported that CBCT imaging is not a reliable method for diagnosing radicular cysts.The present case supports this assertion. The lesion associated with the right maxillary lateral incisor in the present case displayed many of the criteria used for the diagnosis of radicular cysts, which have been described as: well-defined uniform borders, a ballooning appearance, uniformly radiolucent lumen, perforation of the cortical plate and a size greater than 20mm in diameter.[19]

Extensive bone loss surrounding open apices presents an additional clinical challenge to accurately seal the apex without extrusion of medicaments and other dental materials. A variety of matrices, such as collagen plugs, have been proposed as preliminary barriers to prevent over-extrusion of materials during apexification procedures. In recent years, platelet-rich fibrin (PRF) has been used as biocompatible, economical alternative barrier material that can additionally promote angiogenesis and wound healing.[21] The use of barrier methods may however be technique sensitive. The healing of the periapical bone in the present case provided the clinician with an apical stop- therefore not necessitating the use of a preliminary apical barrier or the necessity of apical surgery with retrograde filling.

CONCLUSION

The present case demonstrates the successful non-surgical endodontic treatment of a maxillary lateral incisor, classified as Cvek Stage 4 of root development, using TAP medicament and conventional MTA-barrier apexification. Clinicians should be aware that alternative inter-appointment medicaments, such as TAP, may be beneficial in cases where conventional CH paste proves unsuccessful and that large periapical lesions of endodontic origin may heal sufficiently with non-surgical endodontic treatment alone and no surgical intervention.

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None. The authors declare no conflict of interest exists.

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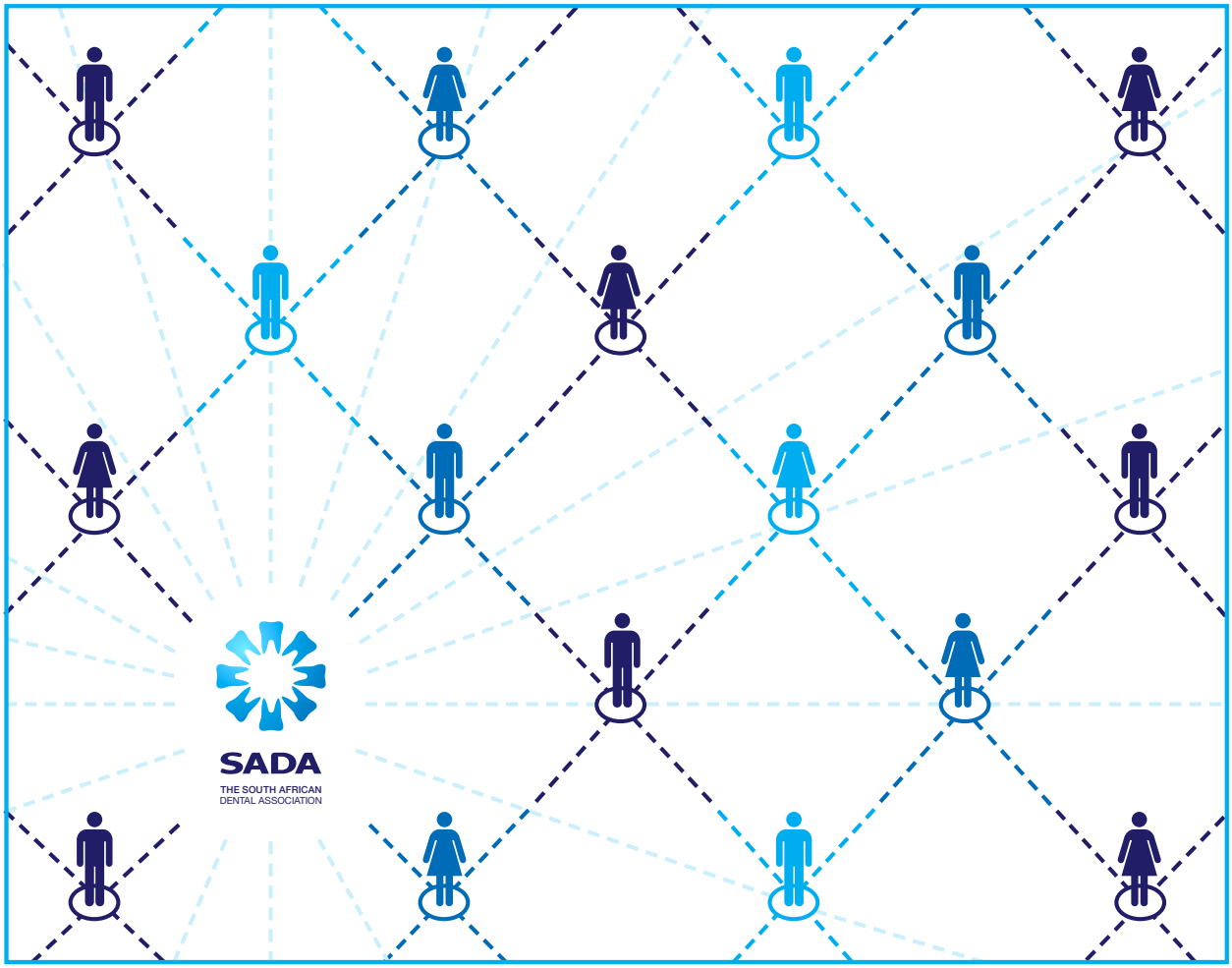

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What's new for the clinician – summaries of recently published papers

SADJ October 2021, Vol. 76 No. 9 p565 - p566

Compiled and edited by V Yengopal

1. Ivermectin for the Treatment of COVID-19: A Systematic Review and Meta-analysis of Randomized Controlled Trial

Roman YM, Burela PA, Pasupuleti V, Piscoya A, Vidal JE, Hernandez AV. Ivermectin for the Treatment of Coronavirus Disease 2019: A Systematic Review and Meta-analysis of Randomized Controlled Trials. Clinical Infectious Diseases. 2021 Jun 28. ciab591. doi: 10.1093/cid/ciab591.

INTRODUCTION

To date, very few treatments have been demonstrated to reduce the burden of morbidity and mortality from COVID-19. Although corticosteroids have been proven to reduce mortality in severe disease,[1] there has been little convincing evidence on interventions that may prevent disease, reduce hospitalizations, and reduce the numbers of people progressing to critical disease and death.

Ivermectin is a well-known medicine that is approved as an antiparasitic by the World Health Organization and the US Food and Drug Administration. It is widely used in low- and middle-income countries to treat worm infections. Also used for the treatment of scabies and lice, it is one of the World Health Organization's Essential Medicines.[1] With total doses of ivermectin distributed apparently equalling one-third of the present world population,[1] ivermectin at the usual doses (0.2–0.4 mg/kg) is considered extremely safe for use in humans.[1] In addition to its antiparasitic activity, it has been noted to have antiviral and anti-inflammatory properties, leading to an increasing list of therapeutic indications.

South African authorities approved the use of a drug used to control parasites in humans and livestock to treat coronavirus patients. Additionally, in January 2021, the South African Health Products Regulatory Authority (SAHPRA) announced that ivermectin, would be allowed for use on compassionate grounds in a controlled-access program. Ivermectin locally has been used for the prevention and/or management of Covid-19 infection. This has resulted in a huge black market trade of ivermectin in South Africa as many health professionals and others have taken to social media and other platforms to profile this drug as an effective treatment for the covid-19 viral infection. Roman and colleagues (2021)[1] conducted a systematic review and meta-analysis to evaluate treatment effects of Ivermectin (IVM) on clinical outcomes and adverse events (AEs) in people with COVID-19.

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MATERIALS AND METHODS

A search strategy was developed for use in 5 databases: PubMed-MEDLINE, EMBASE-OVID, Scopus, Web of Science, the Cochrane Library; and preprints from www.medrxiv.org, www.preprints.org, and www.ssrn.com. The search was limited until 22 March 2021. Randomized clinical trials (RCTs) in any language reporting benefit or harm outcomes of IVM as treatment in patients with COVID-19, both non-hospitalized and hospitalized, irrespective of COVID-19 severity were considered for inclusion. Studies assessing prophylaxis for COVID-19 infection were excluded. Controls were the standard of care (SOC) or placebo. Two investigators independently screened titles and abstracts and then assessed full texts of selected abstracts. Discrepancies were resolved through discussion or by a third investigator.

Primary outcomes were all-cause mortality rate, length of hospital stay (LOS), and adverse events (AEs). Secondary outcomes were SARS-CoV-2 clearance

on respiratory samples, clinical improvement, need for mechanical ventilation, and severe AEs (SAEs).

Two investigators independently extracted the following data: country, sample size, dose and duration of IVM treatment, type of control group (SOC vs placebo), COVID-19 severity, percentage of reverse-transcription polymerase chain reaction (RT-PCR) results positive for SARS-CoV-2, study setting (hospitalized vs non-hospitalized), mean age, proportions of female patients and patients with hypertension, diabetes mellitus, or cardiovascular disease, outcomes, and duration of follow-up. COVID-19 disease severity was defined as mild, moderate, or severe according to the WHO classification. Discrepancies were resolved through discussion and consensus.

Two investigators independently assessed the risk of bias (RoB) using the Cochrane Risk of Bias 2.0 tool for RCTs; disagreements were resolved by discussion with a third investigator. This tool evaluates 5 domains of bias: randomization process, deviations from intended interventions, missing outcome data, measurement of the outcome, and selection of the reported results. The RoB for each of the 5 domains and overall was described as low, some concerns, or high.

Inverse variance random effect meta-analyses were performed to evaluate the effects of IVM versus control on outcomes. Effects of meta-analyses were reported as relative risk (RR) for dichotomous outcomes and as mean difference for continuous outcomes.

The heterogeneity of effects among studies was quantified using the I2 statistic (I2 >60% indicates high heterogeneity). Sensitivity analyses excluding RCTs with shorter follow-up (i.e., <21 days) were planned for the primary outcomes. The certainty or quality of evidence (QoE) was evaluated using GRADE methods, which cover RoB, inconsistency, indirectness, imprecision, and publication bias

RESULTS

The search yielded 256 citations with an additional 9 citations identified in preprint Web pages; 253 records were excluded. After assessing 12 full texts, the researchers identified 10 RCTs (n = 1173). Two full texts were excluded; there was no control group in one of these studies, and an outcome of no interest (duration of fever) was the only outcome reported in the other.

One RCT was conducted in Spain and the other 9 were conducted in low- and middle-income countries. Sample sizes for RCTs ranged from 24 to 398 patients. IVM doses were heterogeneous in terms of total doses (ranging from 12 mg to 210 mg) and duration (ranging from 1 to 5 days). Controls were the SOC in 5 RCTs and placebo in 5. Most RCTs were conducted in patients with mild COVID-19: mild in all or most patients in 8 RCTs moderate in 1], and mild and moderate in[1].

All patients had RT-PCR results positive for SARS-CoV-2 at baseline, except in 2 RCTs. Mean or median ages ranged from 26 to 56 years, and the percentage of female patients from 15% to 78% and most patients did not have hypertension, diabetes mellitus, or cardiovascular disease. Evaluated outcomes were also heterogeneous across RCTs, and the duration of follow-up ranged from 5 days to 30 days
Eight RCTs had a high risk of bias (RoB), one had some concerns of bias in the randomization process, and one had a low RoB.

IVM, compared with control treatment, did not have an effect on:

- the all-cause mortality rate in 5 RCTs (RR, 0.37 [95% CI, 0.12–1.13]; I2 = 16%; very low quality of evidence)
- length of hospital stay (LOS), in 3 RCTs (mean difference, 0.72 days [–0.86 to 2.29 days]; I2 = 0%; very low quality of evidence)
- Adverse events (AEs) in 3 RCTs (RR, 0.95 [0.85–1.07]; I2 = 0%; low quality of evidence)
- Compared with control treatment, IVM had no effect on severe adverse events (SAEs) in 3 RCTs (RR, 1.39 [95% CI, 0.36–5.30]; I2 = 0%; low quality of evidence or on viral clearance in 4 RCTs (RR, 0.96, [.79–1.16]; I2 = 0%; low quality of evidence

Subgroup analyses by severity of COVID-19 disease or risk of bias (RoB) were consistent with main analyses. Sensitivity analyses excluding studies with follow-up <21 days showed similar effects as primary analyses for all-cause mortality rate and length of hospital stay (LOS). The statistical heterogeneity of effects for all-cause mortality was 0% in sensitivity analysis.

CONCLUSIONS

The systematic review with meta-analyses found that, compared with standard of care (SOC) or placebo, IVM did not reduce all-cause mortality rate, length of hospital stay (LOS), respiratory viral clearance, adverse events (AEs), or severe adverse events (SAEs) in RCTs of patients with mild to moderate COVID-19. The reviewers did not find data about IVM effects on clinical improvement or the need for mechanical ventilation. In view of the current evidence, the reviewers concluded that IVM is not a viable option for treating patients with COVID-19, and should be used only within clinical trials.

Implications of practice

Many patients will ask oral health professionals for their views on the efficacy of IVM for the treatment of COVID-19. Responses and/or opinions should be based on high quality evidence as used in systematic reviews with meta-analyses of randomised clinical trials.

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Maxillofacial Radiology 194

SADJ October 2021, Vol. 76 No. 9 p567

Jaco Walters[1]

CASE

A 19-year-old female presented with a firm tender swelling in the posterior left mandible. Teeth present in the quadrant tested vital with no discernible carious lesions. A pantomograph (Figure 1) revealed a mixed radiopaque mass that appears to be associated with the 36 roots. What would your provisional diagnosis be?


Fig. 1

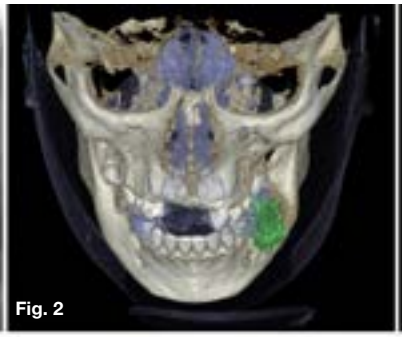
Fig. 2


Fig. 3

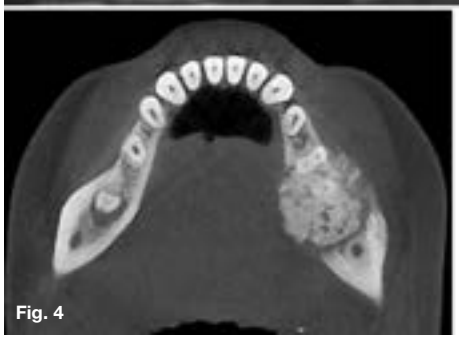
Fig. 4


Fig. 5


Fig. 6

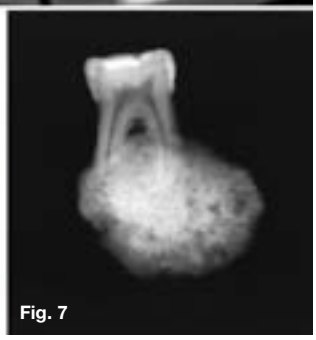
Fig. 7

INTERPRETATION

CBCT imaging and analysis was performed. Observe unilateral expansion by the distending soft tissue outline illustrated through 3D rendering (Figure 2). Sagittal oblique (Figure 3) and axial (Figure 4) slices depict a round heterogenous predominantly high-density lesion with an encompassing thin uniform less dense peripheral band. Irregular root resorption, displacement of the inferior alveolar nerve canal, buccal-lingual cortical expansion, thinning, and interruption was apparent. Irregular thickening at the inferior border and surrounding osteosclerosis were noted. A macroscopic view (Figure 5), photomicrograph (Figure 6), and conventional radiograph (Figure 7) of vertically sectioned surgical specimens of similar lesions. Note the intimate relationship with the tooth roots.

The cementoblastoma is a benign odontogenic tumour of ectomesenchymal origin. The WHO characterise it as established sheets of cementum-like tissue containing large numbers of reversal lines being unmineralized at the periphery or active growth regions. Considered rare with a prevalence of 0.2% to 6.2% amongst odontogenic tumours. With an age range of 8 to 44 years and predilection for the second and third decades. Approximately 46% are diagnosed before the age of 20. Gender ratios are seemingly negligible.

The majority present in the posterior mandible involving the first permanent molar, with primary tooth involvement considered to be rare. Common presentation is a unilateral slow-growing firm expansile swelling. In contrast to benign odontogenic tumours' hallmarks, pain and occasional paraesthesia may present. Radiological features of an ovoid radiopaque mass fused with a tooth root surrounded by a thin well-demarcated radiolucent zone are characteristic. Root resorption, periodontal ligament space and pulp chamber obliteration are common findings. Appearance may vary depending on the degree of mineralization. Early lesions are more radiolucent with increasing density as they mature. Due to persistent growth and involvement of adjacent structures removal is recommended by complete enucleation. A low rate of recurrence is reported.

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Is "Failure to treat" a Treatment failure?

SADJ October 2021, Vol. 76 No. 9 p568-p570

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ABSTRACT

Over-servicing in dentistry has been widely reported on and censured due to the potential physical, social and financial harms it can cause a patient. In contrast, under-treatment is less often noticed or raised as a concern as it seldom presents with overt signs of carelessness or disregard. In addition, it is usually not accompanied by any time or financial burdens, thus patients rarely complain about it. While some practitioners may argue that failure to treat is a form of negligence, this paper will explore if, and when it could be justified. While practitioners may never reach a consensus agreement, the ultimate message is that all treatment should be patient centred and should only commence following their educated, considered, autonomous, and voluntary consent.

INTRODUCTION

Over servicing in dentistry by means of carrying out unnecessary, inappropriate, excessive or fraudulent treatment has been the focus of many ethical, legal and professional altercations. It occurs when practitioners carry out any form of procedure that is "not medically or clinically indicated, not in accordance with recognised treatment protocols, and without regard for the patient's finances or best interests".[1] This includes provision of unnecessary treatment that will produce little if any improvement in the patient's health outcomes.[2] Not providing or delaying treatment falls at the opposite end of the spectrum, and may result in clinicians being accused of "failure to treat" or "supervised neglect".[3] This paper will use an actual patient case to discuss and debate if no treatment may at times be justified and deemed the most appropriate and best management choice.

Literature review

Over servicing refers to the provision of unnecessary, excessive or ineffective procedures. Examples include accepting perverse incentives for preferential use of drugs, diagnostic aids, investigations or restorative materials; performing dated and more aggressive interventions than recommended; treating conditions that were asymptomatic and not likely to cause problems, carrying out purely cosmetic work; concealing all information and depriving patients the opportunity to make autonomous, and informed decisions; or treating conditions where a more preventative approach would have been better.[2] Given that all of these could result in some form of harm, they may be considered malpractice.

Supervised neglect describes "a situation where a patient's oral health has been allowed to deteriorate over time, despite their regular dental visits".[3] This is not the same as where the patient's oral health has deteriorated despite the dentist's best efforts and concerns. One way to differentiate between them is to look at the patient's clinical records. If the dentist had correctly identified the patient's problems, carried out appropriate investigations, diagnosed the situation and presented the patient with a comprehensive treatment plan and options, but the patient had "declined the recommendations for treatment", the records would reveal this. In that case, the dentist would have been justified to have only monitored their condition, and not guilty of neglect or malpractice.

A different situation arises with patients who present with many unexpected emergencies, as they often risk not having other necessary procedures dealt with.[4] Here too, the dentist cannot be accused of supervised neglect if they inform the patient of the need for follow up interventions and the patient does not do so. A clinician may also have observed some "less than optimal restorations over several years and seen little or no deterioration in them". If the patient has remained asymptomatic, they may have felt justified not to replace these. Provided the patient was aware of this "planned inactivity" and agreed with the cautious approach, the dentist cannot be guilty of any wrongdoing.

Determining supervised neglect is never easy, as dentists tend to "look more critically" at work carried out by others, than if they had performed the procedures themselves.[3] However, there are some clear cut cases where neglect is indisputable, such as when the dentist does not focus on the patient's needs; where they may be physically or mentally unwell, but continue to work in a compromised state; where they are too busy and then neglect treating each patient comprehensively; or where they "assume" a patient will not be interested in certain procedures and do not offer them the options.[3,4] In all of these cases, there may not be actual malpractice but there is certainly clear negligence. A very different scenario is where the patient presents with a sub-optimal oral condition and has teeth that need treatment, yet is comfortable, pain and infection free, and does not wish to have these teeth worked on. The dentist too may be cognisant that "helping always carried a risk of harming"[5], particularly in situations where the patient has asymptomatic, but severely compromised teeth. They may adopt a philosophy of never causing a patient to leave their

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1. **Leanne M Sykes:** Primary author - 60%
2. **Avish Jagathpal:** 15%
3. **Charles Bradfield:** 15%
4. **Michael Cronje:** 10%;

Figure 1. Panoramic radiograph taken on the day of patient presentation

Figure 2. a) Intra oral view of maxilla showing lost crowns on the 25 and 26. 2b) Study cast of the maxilla.

rooms worse off than when they arrived, and consciously chose planned inactivity. It is important to note that this is not the same as a situation where a patient refuses treatment despite recommendations for its need.

Case presentation

A 76-year-old male patient presented for treatment requesting a maxillary partial denture. Based on his history and clinical examination it was evident that he had received extensive dental treatment in the past, with every tooth in his mouth having some form of restoration. Despite this, he had lost all but three of his maxillary teeth and the mandibular dentition had many failing restorations in need of attention. A detailed intra oral examination and radiographic analysis revealed the following: teeth 25 and 26 had poor endodontics, post and cores and had previously had crowns placed. The patient said these had fallen off years ago and as there was no pain, he had not bothered to get them re-cemented. The mandible had a broken down 37, post core crowns on the 36 and 35, full coverage crowns on the 34 to the 43, a failing three-unit bridge from the 44 to the 46 and a failing post core crown on the 47.

An ideal treatment plan was drawn up and the patient was advised that many teeth needed root canal treatment or re-treatment and may even be lost depending on the clinical findings. He responded that he was pain-free, none of his teeth were worrying him, and was said that he did not want to have any further restorative work done. He added that his remaining teeth had served him well for many years and he didn't want to risk losing any more teeth unless they started to give him trouble. He was adamant that he only wanted to have a maxillary partial denture made. After a lengthy discussion, the clinician agreed to this on the understanding that the patient had been fully informed and had actively refused any other treatment.

DISCUSSION

In this case the dentist agreed to provide the patient with a partial denture, but also explained in deatil about the poor periodontal status of his mandibular teeth, and the need to have this addressed. The patient did concede to consider this suggestion. As such, the treatment provided cannot be considered under-servicing, negelct or malpractice. However it would be prudent if the dentist also monitored the patient, and followed up with reminders if he didn't return for the periodontal therapy.

The principle of beneficence (doing good)[5] is a reminder that clincians' primary obligation is to their patients. As such when faced with any treatment decision, giving advice or making recommendations, they need to not only ensure it is based on the latest scientific evidence, but must

Figure 3. a) Intra oral view of mandible showing heavly restored dentition b) Study cast of the mandible

also consider whether it is in the patient's best interest and approporate for their current situation.[3,6] Inadequate treatment, failure to diagnose pathology or performing work that does not meet the standard of care is clearly unethical and not in contention. However, undertreating raises many different questions.[4] The dentist may feel that the situation is relatively stable and could a adopt a "watch and see" approach.

Alternatively they may feel that given the patient's dental history and current situation, the deterioration is likely be progressive and tooth loss is inevitable. In both cases they could justify their inactivity on the grounds that they will be saving the patients time, expense or discomfort by not intervening. They may truly believe their decision is based on the patient's best interests. Their actions could be defensible if they have also fully explained the situation to the patient, provided them with insight into the pros and cons of all treatment options as well as risks associated with no treatment, and allowed them to make an educated, autonomous decision based on their own needs and concerns.[4] To safeguard themselves, all discussions and decisions must be clearly documented in the patients record files.

A contrary view is that of the clinician who believes that "professionals have a duty to protect patients from harm and promote their welfare".[4] To this end they feel obliged to "provide competent and timely delivery of dental care within the bounds of clinical circumstances", taking into account the patients needs, desires and values.[4] If the patient's wishes and priorities are in contradiction to their expert opinion and ethical duty of care they may resolve to refuse to treat or provide piecemeal services. While this may be seen as a paternalistic approach, it allows them to remian true to their convictions or moral ethos.

While practitioners may differ in their opinions and treatment philosophies, the ultimate question to be answered is whether limited treatment can be justified or has the patient suffered from supervised neglect because of it. In the present case scanario, the dentist had carried out a comprehensive examination and identified all the areas of concern. These had been discussed with the patient including an explanation of the risks and benefits associated with treatment and with no intervention. The patient understood the choices and had consciously chosen minimal intervention. The failure to treat was thus not a falure in performance on the part of the clincian. In supervised neglect the dentist may have either not identified the dental pathology, or not informed the patient of this and as such denied him the opportunitty of having it addressed. Faiulre to treat could then be deemed poor practice or neglect.

In this case scenario, the authors had conflicting opinions. Some agreed to not treat the remianing maxillary teeth and to provide the denture as desired. While another said that "if I cannot do ideal treatment then I will refuse to treat at all". All of them however did agree that the periodontal status should not be ignored. Both approaches can be justified in terms of their individual work ethos, provided the patient was fully informed, and ultimaltey made the final autonomous and educated decision for themselves.

CONCLUSION

When faced with difficult treatment choices and clinical dilemmas the practitioners should consider all the options bearing in mind the code of ethics set out by The American Dental Association. This states "Professionals have a duty to be honest and trustworthy in their dealings with people. As such, the dentist's primary obligations include respecting the position of trust inherent in the dentist-patient relationship, communicating truthfully and without deception, and maintaining unfaltering integrity at all times".[4]

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CPD questionnaire

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

GENERAL

Dentistry in South Africa and the need for management and leadership training.

1. Choose the CORRECT answer. Which of the following are real concerns about dentistry in South Africa
   A. Financial constraints
   B. High cost of imported consumables
   C. Reduced support from medical schemes
   D. All of the above.

2. Select the CORRECT option. The senior managers agreed the following to be crucial for dentists to cope in the changing environment:
   A. Leadership skills only
   B. Management skills only
   C. Both leadership and management skills
   D. None of the above

3. Which of the following is CORRECT. The themes identified about the state of dentistry in South Africa (SA) included
   A. Affordable dental services
   B. Increased pay-outs from third party funders
   C. Marginalisation of dentistry from other medical professions within the health sector.
   D. All of the above

Alveolar bone resorption following tooth extraction characteristically illustrated.

4. Select the CORRECT statement. The alveolar process:
   A. has architecture that provides it with flexibility and low weight
   B. surrounds and supports the teeth
   C. undergoes constant resorption following tooth loss
   D. all of the above are correct
   E. only b) and c) are correct

5. Regarding the cellular compartment of bone, which of the following statements is CORRECT?
   A. Osteoblast and osteocytes arise from connective tissue blood vessels
   B. Osteoblasts are responsible for dissolving mineralised components of the bone
   C. Osteoclasts, bone lining cells and pericytes all arise from the same precursor cells
   D. Osteoclasts are responsible for dissolving mineralised components of the bone
   E. Osteoblasts develop a ruffled border during bone formation and degradation

6. Which of the following statements is CORRECT? Following tooth loss:
   A. The socket are initially filled with dissolved osteoid
   B. The sockets are initially filled with fibrous connective tissue
   C. The healing process is associated with a reduction in ridge height
   D. The ridge bone loss is initially slow and then speeds up as patients chew more
   E. There is generally more bone loss in the maxilla than the mandible

A review of the South African National Oral Health Policy

7. Choose the CORRECT answer. According to the National Oral Health Policy review, which one of the following objectives had not been obtained for children aged 1-6 years by the year 2000?
   A. To obtain a 60% caries free prevalence
   B. To obtain an 80% caries free prevalence
   C. To obtain a 50% caries free prevalence
   D. To obtain a 90% caries free prevalence

8. Which answer is CORRECT. Which one of the following is a positive strength of the National Oral Health policy?
   A. Human resources encouraged to improvise as they see fit
   B. Involve the community in planning
   C. Make oral health services accessible and expensive to all
   D. Not allowing the community practice of self-care

9. Select the CORRECT statement. Which one of the following is considered a weakness of the National Oral Health policy?
   A. Specialists are put in charge of all programs
   B. No evidence of any of the intentions being translated into action
   C. All programs are funded by district
   D. There is a clear monitoring and evaluation plan

Resolution of a large periapical lesion in an immature maxillary lateral incisor with the aid of triple antibiotic paste.

10. Which answer is CORRECT. What are endodontic procedures performed to achieve apical closure in permanent teeth are referred to as?
    A. Apexification
    B. Hemi-section
    C. Apicectomy
    D. Vital pulp therapy
    E. None of the above

11. Select the CORRECT answer. Which of the following is not a criteria used for the diagnosis of radicular cysts?
    A. Well-defined borders
    B. Ballooning appearance
    C. Perforation of the cortical plate
    D. Size greater than 20mm in diameter
    E. Positive response to vitality testing

Effect of flask closure method on occlusal vertical dimension of complete upper and lower dentures.

12. Choose the CORRECT option. The factor/s responsible for occlusal discrepancies in the processed dentures is/are
    A. Improper flask closure
    B. Warpage of the denture base
    C. Change in the relationship of a tooth / teeth to the master cast during processing
    D. All of the above

13. Which answer is CORRECT. The provision of insufficient freeway space to lead to
    A. difficulties approximating the lips
    B. discomfort brought about constant stimulation of the muscles
    C. cheek biting
    D. All of the above

Should dental amalgams be included in dental training? The perspectives of dental academics at a university in South Africa.

14. Which answer is CORRECT. Ninety seven percent of dental schools in North America continue to teach and train with dental amalgam. However, the teaching time allocated to this is found to be
    A. 20%
    B. 30%
    C. 40%
    D. 50%
    E. More than 50%

15. Select the CORRECT statement. Some of the challenges associated with the training of dental amalgam include:
    A. Increased student numbers at the university
    B. Quota requirements for dental restorations
    C. Safety of dental amalgam due to its mercury content
    D. The conflict between theoretical knowledge and clinical requirements
    E. All of the above

16. Which percentage is CORRECT. What percentage of dental academics feel that dental amalgam should be replaced entirely in dental training
    A. 5%
    B. 15%
    C. 25%
    D. 35%
    E. 45%

Radiology Corner

17. Select the CORRECT statement. Histological findings regarding the cementoblastoma:
    Distributive justice includes:
    A. Suggest it may be considered the only true neoplasm of cemental origin.
    B. Show trabeculae of mineralized material lined by cementoblasts, cellular fibrovascular tissue, and multinucleated giant cells.
    C. Display hard tissue appearing as cementum, exhibiting prominent reversal lines, and plump hyperchromatic cementoblasts.
    D. All of the above

18. Choose the CORRECT statement. The cementoblastoma commonly presents:
    A. As a mixed multifocal radiopaque mass.
    B. With paraesthesia and perforation of the cortex.
    C. In association with a painful non-vital tooth.
    D. Periodontal ligament obliteration and root resorption.

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

19. Which of the following is CORRECT. In the Roman et al systematic review, ivermectin compared with control treatment,
    A. did not have an effect on the all-cause mortality rate (RR, 0.37 [95% CI, 0.12–1.13] [p > 0.05…not statistically significant]
    B. did not have an effect on the all-cause mortality rate (RR, 0.37 [95% CI, 0.12–1.13] [p < 0.05… statistically significant]
    C. did have an effect on the all-cause mortality rate (RR, 0.37 [95% CI, 0.12–1.13] [p > 0.05…not statistically significant]
    D. did have an effect on the all-cause mortality rate (RR, 0.37 [95% CI, 0.12–1.13] [p < 0.05…statistically significant]

20. Select the CORRECT answer. "in silico" studies refer to studies that:
    A. occur in the laboratory
    B. occur in the mouth of the patient (clinical)
    C. are conducted or produced by means of computer modelling or computer simulation
    D. occur in the community

ETHICS
Is "Failure to treat" a Treatment failure?

21. Select the CORRECT option. Over servicing refers to:
    A. the provision of excessive procedures
    B. the provision of ineffective treatment
    C. the provision of excessive medication
    D. only a) and c) are correct
    E. all of the above are correct

22. Which of the following is CORRECT. A dentist may be guilty of supervised neglect if:
    A. see patients as emergencies and only complete the work later
    B. fail to offer patients all the possible treatment options
    C. make assumptions about what patients would like done
    D. only b) and c) are correct
    E. all of the above are correct

23. Select the CORRECT answer. In following the principle of beneficence (doing good)
    A. clinicians must base decisions on their experience
    B. must base their decisions on the patients desires
    C. must base their decisions on the patients best intersts
    D. must base their decisions on potential future outcomes

24. Which of the following is CORRECT. Asymptomatic pathology should:
    A. not be disturbed
    B. monitored until it gets worse
    C. treated appropriately as soon as detected
    D. ignored so as not to alarm the patient

25. Which of the following answers is CORRECT. It may be considered "Failure to treat" if:
    A. the dentist makes a decision based on the risk: benefit ratio
    B. the patient understands the options and choses minimal intervention
    C. the patient is persuaded to "rather watch and see"
    D. the patients decision is based on a clear understanding

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