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Common sugarbush
(Protea caffra)

A unique plant that is occasionally cultivated in tropical gardens to add texture and color, common sugarbush can either grow as a tree or shrub in its natural South African habitat. In areas where wildfires are common, it has a bush-like growth habit.

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† Data on file. Euromonitor International Limited; Beauty and Personal Care 2024 edition, per Mouthwashes/Dental Rinses category definition, retail value RSP, 2023 data.

References: 1. Milleman K, Bosma M *et al.* Twelve Week Efficacy of Virutally Supervised Mouthrinse and Flossing. **2.** Presented at AADOCR 2023 Annual Meeting, Abstract # 0550.

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From Trends to Trust: Harnessing Social Media for the Future of Dentistry

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Prof NH Wood, Managing Editor, SADJ - BChD, DipOdont(MFP), MDent(OMP), FCD(SA), PhD

Introduction: The Digital Shift in Dentistry

Dentistry has entered a new era where patient engagement, professional growth, and clinical trends are shaped as much by algorithms as by evidence-based practices. Social media platforms, once the domain of casual networking, have become dynamic spaces that connect dental professionals, educate patients, and can spark global conversations about oral health. For dentists, this digital shift offers unprecedented opportunities but is loaded with complex challenges.

Imagine a young professional scrolling through Instagram, captivated by a polished video showcasing a smile transformation, or a patient whose treatment expectations are influenced by a TikTok trend promoting veneers as the ultimate solution. These scenarios are no longer hypothetical; they reflect the lived realities of a profession navigating the powerful pull of social media. Yet, with opportunity comes responsibility. The same platforms that democratize knowledge and expand visibility can distort patient perceptions, fuel unrealistic expectations, and blur the line between healthcare and commercialization. We need to explore the intricate interplay between social media and the dental profession, its potential to elevate the field, the pitfalls it presents, and the ethical considerations it demands. The central question arises: How can practitioners leverage this digital tool responsibly to enhance patient care, professional development, and the integrity of the profession itself?

Enhancing Professional Networking and Education

In an era where borders are no longer barriers, social media has become a vital tool for connecting dental professionals worldwide. Platforms like LinkedIn, Instagram, X, and Facebook have evolved into digital hubs where dentists share cases, discuss challenges, and celebrate successes. The result? A global community of professionals fostering collaboration, innovation, and continuous learning.

For dentists these benefits are profound. A practitioner in South Africa can engage with peers in Europe or Asia, exchanging insights about complex cases or the latest technologies. Social media groups dedicated to dental education host live discussions, offer clinical tips, and provide access to virtual conferences, all with the swipe of a finger. Platforms like YouTube and TikTok host a wealth of instructional videos, from mastering advanced endodontic techniques to refining cosmetic procedures, making continuing education more accessible than ever.

But it is not just about access — it is about engagement. Dentists who actively participate in these digital communities gain more than knowledge: they gain visibility. Sharing successful cases or innovative approaches can elevate a practitioner's reputation, opening doors to collaborations, referrals, and even mentorship opportunities.

However, digital networking comes with its own set of challenges. The unfiltered nature of social media means that not all shared information is accurate or evidence-based. Practitioners must critically evaluate what they consume online, ensuring that the tips and techniques they adopt align with best practices and especially with evidence-based scientific standards. Furthermore, while showcasing clinical work can build credibility, it must be done ethically, respecting patient confidentiality and ensuring transparency about results.

Social media's role in professional networking and education is undeniable, but its true power lies in how dentists choose to engage. By participating thoughtfully and ethically, practitioners can turn these platforms into catalysts for personal and professional growth.

Patient Engagement and Practice Growth

Social media has transformed how dental professionals interact with their patients, opening a direct line of communication that was once unimaginable. Platforms like Instagram, Facebook, and TikTok serve as virtual storefronts where dentists can showcase their work, educate their audience, and build trust, all before a patient even steps into the clinic. This newfound engagement is reshaping patient expectations and the way dental practices grow.

Educating Patients Beyond the Chair

Social media offers a unique opportunity to educate patients in a format that is accessible, engaging, and visually compelling. A well-crafted post or video can explain complex procedures like root canals, emphasize the importance of preventive care, or debunk myths about treatments. For example, a short TikTok video demonstrating proper flossing techniques might reach thousands, if not millions, of viewers, far more than traditional in-office consultations could. By providing credible, bite-sized information, dentists position themselves as trusted sources of oral health knowledge, empowering patients to make informed decisions about their care.

Showcasing Expertise and Building Practice Visibility

For practices, social media acts as a powerful marketing tool. Posting before-and-after photos, sharing patient testimonials, or showcasing advanced procedures builds credibility and attracts potential patients. Creative and consistent engagement can amplify a practice's visibility, especially in competitive markets. For instance, a South African dentist focussing in smile makeovers can use Instagram to reach a local audience interested in cosmetic dentistry, distinguishing themselves from competitors.

The Risks of Over-Commercialization

The push for visibility and growth can come at a cost. The over-commercialization of dentistry on social media has led to concerns about shifting perceptions of the profession. When platforms focus heavily on aesthetics (highlighting veneers, whitening, or other high-margin procedures), they risk framing dentistry as a luxury service rather than essential healthcare. This trend can create unrealistic expectations for patients, who may prioritize cosmetic outcomes over functional health. Furthermore, there is the ethical challenge of ensuring that shared content reflects reality. Misleading photos, exaggerated claims, or omitting potential risks can erode trust. A polished social media presence may bring patients through the door, but if expectations are unmet, it could damage a practitioner's reputation.

Striking the Right Balance

The key to effective patient engagement lies in balance. Social media should complement, not replace, the clinical experience. Dentists must remain educators and advocates first, using these platforms to build relationships rooted in trust and transparency. By focusing on education and ethical marketing, practitioners can leverage social media to not only grow their practices but also enhance the public's understanding of oral health.

The Influence of Social Media Trends on Patient Expectations

From viral smile makeovers to "ToothTok" trends, social media has become a driving force in shaping patient perceptions and expectations of dental care. Platforms like TikTok, Instagram, and YouTube are filled with influencers showcasing their dazzling transformations, often highlighting treatments such as veneers, teeth whitening, and aligners. While these trends can inspire patients to prioritize their oral health, they also create a double-edged sword for dental professionals: an influx of interest, but often accompanied by misconceptions and unrealistic expectations.

The Power of Trends in Cosmetic Dentistry

Social media trends have brought cosmetic dentistry into the spotlight, turning procedures like composite bonding, whitening, and orthodontic aligners into sought-after treatments. For dentists, this presents an opportunity to expand their patient base and increase the uptake of elective procedures. However, the downside is that these trends often reduce complex treatments to simplified, glamourized outcomes. Patients may come in requesting "Hollywood smiles" without understanding the long-term implications, costs, or limitations of such procedures.

For example, the viral promotion of instant veneers as a quick-fix solution rarely addresses the need for proper diagnosis, preparation, or maintenance. Patients influenced by these trends may overlook the importance of preserving natural tooth structure or the potential risks of over-treatment. It falls to dental professionals to navigate these conversations delicately, balancing patient desires with evidence-based care.

Challenges in Correcting Misconceptions

One of the most significant challenges dentists face is managing patient expectations shaped by social media. A patient who has seen a dramatic transformation on Instagram may expect similar results, even if their clinical case or budget does not align. Furthermore, "DIY dentistry" tutorials that promote unsafe practices like at-home composite bonding or mail-order aligners pose a direct risk to patient health.

Dentists must step into the role of educators and advocates, guiding patients away from misinformation and toward treatments that prioritize their oral and systemic health. Addressing these misconceptions requires patience, clear communication, and a strong emphasis on ethical practice.

The Dentist's Role in Guiding Trends Responsibly

While social media trends can complicate patient interactions, they also offer a powerful platform for dentists to lead the conversation. By sharing accurate information, dispelling myths, and showcasing real-world outcomes, practitioners can influence trends in a positive direction. For instance, posts that emphasize the importance of maintaining natural

teeth, highlight the value of preventive care, or showcase minimally invasive procedures can counterbalance the allure of quick-fix solutions.

Moreover, dentists can advocate for treatments that align with patient health and well-being rather than with purely aesthetic goals. A focus on education can help patients understand that while social media trends may inspire their interest, their treatment should be guided by individual needs and long-term outcomes.

Striking a Balance Between Trend and Truth
Social media trends will continue to shape patient expectations, but it is up to the profession to harness their power responsibly. By engaging thoughtfully with these trends, dentists can not only attract new patients but also elevate the standard of care. Social media, when used wisely, can bridge the gap between aspiration and education, ensuring patients make informed decisions that reflect both their desires and their best interests.

Ethical and Legal Considerations

As the role of social media grows in dentistry, so too does the importance of ethical and legal responsibility. While platforms like Instagram and TikTok offer unprecedented opportunities to engage with patients and promote services, they also present significant challenges. Navigating these digital spaces requires a careful balance between innovation, professionalism, and compliance with regulatory frameworks.

Maintaining Patient Confidentiality
One of the most critical ethical challenges in social media use is safeguarding patient confidentiality. Sharing clinical cases or testimonials can enhance credibility and attract patients, but even subtle oversights such as including identifiable features in photos can breach confidentiality. Dentists must ensure that all shared content complies with the POPI act, with privacy regulations and that explicit, documented informed consent from patients is obtained. Failure to do so not only risks legal repercussions but also undermines patient trust.

Avoiding Misinformation and Misleading Content
The pressure to create engaging content can lead some practitioners to oversimplify, exaggerate, or misrepresent outcomes. Photos edited for perfection, videos showcasing extreme cases without context, or promises of "pain-free" results for every procedure can all set unrealistic expectations, and is blatantly dishonest. Such practices not only misinform the public but also damage the credibility of the profession. Ethical content creation demands transparency and honesty. Sharing the challenges, risks, and realistic outcomes of treatments fosters trust and positions the dentist as a credible source of information. The goal is to educate and empower patients, not to mislead or manipulate them for commercial and financial gain.

Professionalism in the Public Sphere
Social media blurs the line between personal and professional personas, making it essential for dentists to always maintain professionalism. Inappropriate comments, casual language, or controversial posts can harm a practitioner's reputation and diminish the respect associated with the profession. Regulatory bodies in many countries, including South Africa, have issued guidelines on maintaining professionalism in digital spaces, underscoring its importance.

Legal Implications and Regulatory Compliance
In addition to ethical concerns, dentists must adhere to legal requirements governing social media use. These include ensuring that advertising complies with truth-in-advertising laws, avoiding unsubstantiated claims, and adhering to health department regulations. Social media is not a free-for-all; it is a public space where practitioners are held accountable for the content they share.

A Framework for Responsible Engagement:

Navigating these ethical and legal challenges requires a clear framework for social media use:

- **Informed Consent:** Always obtain written patient consent for any content featuring their cases.

- **Transparency:** Provide clear, accurate, and evidence-based information in all posts.
- **Professional Boundaries:** Maintain a tone and demeanor that reflects the dignity of the profession. A post can be both professional and fun, but a balance is necessary.
- **Compliance:** Stay informed about relevant laws and regulations governing social media use in dentistry, and of current, evidenced-based best-practice.

Social media offers immense potential for dentistry, but it is a tool that must be wielded with care. By adhering to ethical principles and regulatory standards, dentists can build a digital presence that enhances their reputation, educates the public, and strengthens the profession.

Social Media as a Catalyst for Trends and Innovation

Social media is not just a platform for connection; it is a powerful engine driving trends and innovation in dentistry. With its unparalleled reach and immediacy, social media has accelerated the adoption of new techniques, technologies, and patient-centered approaches. However, with this influence comes a responsibility for dental professionals to critically assess these trends and innovations to ensure they align with evidence-based practices and ethical standards.

Accelerating the Spread of Innovations

Platforms like Instagram, TikTok, and YouTube have brought cutting-edge advancements in dentistry to the forefront. From 3D-printed prosthetics to minimally invasive techniques, social media has allowed practitioners to showcase their use of new tools and materials in real time. This visibility inspires other dentists to explore these innovations, creating a ripple effect across the profession. For example, the promotion of digital workflows such as intraoral scanners, CAD/CAM systems, and 3D printing has been widely shared on social media, illustrating their potential to improve precision, reduce chairside time, and enhance patient satisfaction. Social media has also been instrumental in popularizing aesthetic procedures like composite bonding and aligners, making them more accessible and mainstream.

Bridging the Gap Between Patients and Technology

Social media has not only made dental innovations more visible to professionals but also to patients. As patients see trends like smile makeovers or laser dentistry on their feeds, they become more informed, and sometimes more demanding, about their treatment options. This can lead to increased interest in high-tech solutions but also raises the stakes for dentists to deliver on heightened expectations. Be ready to implement conflict management skills in your practice!

While this patient interest can drive adoption, it is essential for dentists to educate patients about the practicalities, costs, and suitability of these technologies for their individual needs. A laser system may not be the answer for every patient, and the hype surrounding certain trends must be tempered with realistic advice and evidence-based decision-making.

Balancing Innovation with Evidence

The challenge lies in separating genuine advancements from fleeting fads. Not every trend circulating on social media is supported by robust clinical evidence, and dentists must navigate this landscape with a critical eye. For instance, the "no-prep veneers" trend has gained traction online, but its suitability depends on the patient's unique dental anatomy and oral health, which cannot be evaluated through a video or photo alone.

To embrace innovation responsibly, dentists must rely on peer-reviewed research, professional training, and clinical guidelines. Social media can be an incredible source of inspiration, but it is not a substitute for rigorous evaluation.

A Call for Thoughtful Adoption

As catalysts for change, dental professionals have the unique opportunity to shape the narrative surrounding trends and innovations. By sharing real-world outcomes, emphasizing patient safety, and promoting evidence-based practices, dentists can leverage social media to advance the profession while maintaining its integrity.

Harnessing the Power of Social Media in Dentistry

Social media has undeniably become an important component of modern dentistry, reshaping the profession in ways we could hardly have imagined a decade ago. It connects practitioners across the globe, fosters patient engagement, amplifies innovations, and brings dental care into the public consciousness like never before. Yet, with this immense potential comes the responsibility to navigate its complexities with care, professionalism, and integrity.

For general dentists, the challenge lies in striking the right balance. Social media must be more than a tool for self-promotion; it should be a platform to educate, inspire, and uphold the highest standards of patient care. By engaging thoughtfully and ethically, dentists can use social media to bridge the gap between aspiration and reality, ensuring that trends are grounded in evidence and that patient expectations align with achievable, beneficial outcomes.

As a profession, we are uniquely positioned to shape the narrative surrounding oral health on social media. Whether it's by countering misinformation, showcasing innovations responsibly, or advocating for preventive care, dentists have the power to lead the conversation in a way that enhances public trust and strengthens the profession's reputation.

The digital landscape offers endless opportunities, but it is only as effective as the intent behind its use. By embracing social media with a patient-first mindset, we can transform it from a mere tool of engagement into a force for positive change, creating a future where dentistry thrives not only in clinics but also in the global, digital community.

Empowering the future of dentistry:
SADA Dental & Oral Health Congress and Exhibition 2024

SADJ NOVEMBER 2024, Vol. 79 No.10 P525

Mr KC Makhubele – CEO, South African Dental Association

The **SADA Dental & Oral Health Congress and Exhibition 2024**, held at the SunBet Arena, Time Square, Pretoria stood as a beacon of progress and innovation within the dental field. Gathering a record-breaking **714 delegates**, this year's event marked a pivotal moment for South Africa's dental professionals, fostering an inspiring environment for learning, collaboration and celebration of excellence.

Elevating standards through education

Education took centre stage at this year's conference, with a dynamic mix of hands-on workshops, seminars and thought-provoking lectures. The programme offered **19 Continuing Education Units (CEUs)** for full attendance, underscoring SADA's dedication to professional development and the continued pursuit of excellence in dentistry. By combining **19 clinical** CEUs with **10 ethical** CEUs, the conference encouraged delegates not only to sharpen their technical skills but also to uphold the highest ethical standards in practice.

The event's schedule was robust and meticulously crafted, featuring **37 sessions** over three days:

- **Friday:** 11 sessions focusing on practical and ethical challenges in modern dentistry.
- **Saturday:** 7 sessions, emphasising the integration of emerging technologies and techniques.
- **Sunday:** 19 sessions, capped by an engaging "Women in Dentistry" forum.

Each session was designed to arm professionals with new skills and insights, empowering them to lead their practices confidently into the future. Delegates also had access to **15 hands-on workshops**, led by a team of **65 expert presenters** – including **13 international** leaders in dental innovation. These workshops provided invaluable opportunities for immersive learning, allowing participants to practice new techniques and integrate the latest technologies into their repertoire.

Innovation and technology on display

In an age of rapid technological advancement, the conference highlighted how innovation is transforming dental practices and patient care. The exhibition hall was a testament to this progress, bringing together **75 companies** across **109 stands** to showcase groundbreaking products and techniques. A dedicated **German Pavilion** featured 10 leading companies, offering delegates a global perspective on cutting-edge dental tools, materials and software solutions.

Notable societal organisations such as the **South African Association of Paediatric Dentistry (SAAPD), Oral Hygienists Association of South Africa (OHASA) and European Association for Osseointegration (EAO)** also had a presence, providing attendees with the latest research and developments in their respective fields. The exhibition not only served as a marketplace but as a vital educational hub where delegates could explore how new technologies could directly benefit their patients and practices.

A community united in excellence

The highlight of Sunday's programme was the "Women in Dentistry" session, which drew an impressive crowd of **100 delegates**. This session celebrated the contributions of women in dentistry and provided an open platform for discussing the unique challenges they face in the field. This celebration of diversity and empowerment was a cornerstone of the conference, reinforcing SADA's commitment to inclusivity and excellence.

Specialist groups such as **APSA, SASPIO, SASMFOS** and **SASO** lent their expertise and support, further enriching the event. Allied groups, including **DENTASA, OHASA** and **SADTA**, added their voices, fostering a spirit of collaboration and mutual growth that underscored the unity of South Africa's dental community.

Honouring excellence in the field

The conference culminated in an elegant Gala Dinner where attendees, including **190 students** from leading universities such as UP, SMU and Wits, gathered to celebrate outstanding achievements across the industry. The awards ceremony was a highlight, recognising excellence, innovation and dedication within the dental field:

Top Student Achiever Awards: 4 awards celebrating the next generation of dental professionals.
University of the Western Cape – Dr Reinette Van Der Merwe; **University of Pretoria** – Dr Femke Swanepoel; **University of the Witwatersrand** – Dr Sujee Ammaarah; **Sefako Makgatho Health Sciences University** – Dr Yolandi Malan.

Trade awards:
Trader of the Year 2023: Colgate, recognised for its outstanding contributions to the dental industry. **1st Runner-Up:** Wright Millners, **2nd Runner-Up:** Henry Schein Dental Warehouse.

Dental Industry Innovation Awards:
Winner: Colgate, for its pioneering work in advancing dental care technologies. **1st Runner-Up:** Wright Millners, **2nd Runner-Up:** Dentsply Sirona.**Distinguished Professional Awards: Dental Trade Professional of 2023:** Terry Greyling, for his exemplary service to the industry. **Dento-Legal Advisor of 2023:** Dr Alasdair McKelvie, for his leadership in upholding ethical standards in dentistry.

Young Dentists Council Publisher Award 2023

Dr Mokgadi Nkosi – Department of Health.

A lasting impact

The 2024 SADA annual conference has once again proven to be an essential event, bringing together the best minds in South African dentistry to explore the forefront of dental education, innovation and professional practice. As SADA continues its mission to advance the dental profession, this conference stands as a powerful reminder of the collective expertise and shared vision that drives the future of dentistry in South Africa.

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An assessment of Western Cape metro public dental clinics' compliance with the Primary Healthcare Package for South Africa: A set of norms and standards

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A Mohamed-Jacobs[1], V Bookhan, NM Mkhize[2], TK Madiba[3]

ABSTRACT

Introduction

This study explores the compliance of public dental clinics in the Western Cape Metro (WCM), South Africa with the Primary Healthcare Package for South Africa.

Aims and objectives

The study evaluates the availability of prescribed dental consumables, instruments and equipment in primary oral health clinics. Additionally, it seeks to determine the number of clinics providing the basic package of oral health services.

Design

A cross-sectional study.

Methods

This study conducted an audit of 28 public dental clinics in the Western Cape metro. Full-time clinic staff were surveyed using a questionnaire. Equipment and materials were assessed using a checklist. Data analysis was performed using SPSS version 28, summarising quantitative variables with proportions, frequencies, means and standard deviations.

Results

A total of 15 clinics responded out of the 28 invited with a response rate of 53.6%. Only two clinics offered all services in the basic package of care. Eleven clinics had 80% or more of the required equipment. Ten clinics had 80% or more of the required instruments used to treat pain and sepsis. All the clinics had at least 80% of the required consumables.

Conclusion

None of the clinics was compliant with national norms and standards.

Keywords

Instruments, equipment, consumables, dental, Western Cape, public health

Authors' information

1. A Mohamed-Jacobs, *BChD*, *PDD* Implantology, *PgDip* Public Health, Dentist, Western Cape Department of Health and Wellness
   ORCID: 0009-0001-2419-2604
2. V Bookhan, *BDS*, *MDent*, Adjunct professor/Specialist in Prosthodontics, Department of Odontology, School of Dentistry, University of Pretoria, Pretoria, South Africa
   ORCID: 0000-0002-4235-3897
3. NM Mkhize, *BChD*, *MSc Dent*, Dentist/Lecturer, Department of Orthodontics, School of Dentistry, University of Pretoria, Pretoria, South Africa
   ORCID: 0009-0000-5864-2661
4. TK Madiba, *B.Dent Ther*, *BDS*, *DHSM*, *MChD*, Adjunct professor, Head Clinical Unit, University of Pretoria, Department of Community Dentistry, School of Dentistry, University of Pretoria, Pretoria, South Africa
   ORCID: 0000-0002-0171-0595

Corresponding author
Name: Prof TK Madiba
Email: thommy.madiba@gmail.com
Tel: (012) 319 2417
Cell: 084 503 6175

INTRODUCTION

Oral diseases, such as dental caries, periodontal disease, tooth loss and oral cancers, are widespread globally, imposing significant health and economic burdens and diminishing the quality of life for those affected. Despite being largely preventable, oral diseases persist due to prevalent social and economic inequalities, coupled with insufficient funding for prevention and treatment, especially in low-income and middle-income countries (LMICs).[1]

In South Africa there exist gross disparities between public and private dental services, a factor which contributes to unequal access to care. While the private sector often provides more comprehensive services, a significant portion of the population relies on the public sector, where resource limitations can result in gaps in care.[2] This is despite the World Health Organisation's (WHO) initiative for universal access to care.[3]

While the United Nations (UN) adopted a universal political agenda to achieve peace, prosperity and wellbeing for all by the year 2030 through the implementation of the 17 Sustainable Development Goals (SDGs),[4] South Africa still falls short despite the SDG 3 which is aimed at achieving healthy lives and promoting wellbeing for all. Despite having several policies on improving oral health services in South Africa,[5] there has been limited evidence indicating the burden of oral disease has been adequately addressed.[6]

In response to the oral disease burden, public dental clinics were mandated to provide a basic package of care as described in the Primary Healthcare Package for South Africa: A Set of Norms and Standards.[7]

This package of care includes the promotion of oral health through education, prevention of oral disease (fissure sealant and toothbrushing programmes), basic restorations (fillings) and treatment of pain and sepsis (including extractions, bitewing radiographs and scale and polish treatments).[7] The minimum expected outcome of these services includes "exposing at least 50% of primary schools to organised school preventive programmes" and that "everybody in the catchment area is covered by basic treatment services".[7] Each

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dental clinic should have a complete dental unit, dental hand instruments, sterilisation equipment, dental radiographic equipment and the necessary medicines and supplies required to perform various dental clinical procedures. Service delivery standards are derived from the National Oral Health Policy,[8] National Norms, Standards and Practice guidelines for Primary Healthcare, Provincial Operational Health Policy and oral health educational materials.[7]

Dental equipment, instruments and consumables are an essential component in the prevention, diagnosis and treatment of oral diseases[9] and a responsive health system ensures the availability and appropriateness of the required resources to render quality dental services.[10] A lack of resources and nonfunctioning equipment negatively impacts on the clinician's ability to provide effective treatment services and limits access to care.[9]

A study by Rajcoomar[11] conducted in the uMgungundlovu district in KwaZulu-Natal measured public dental clinics compliance with national norms and standards and found that deficient resources led to inadequate service delivery. Dental treatments offered were based on available resources rather than what is clinically appropriate.[11]

Primary Health Care (PHC) facility audits, which include public dental clinics, were conducted in 2011 by the National Department of Health (NDoH) in preparation for the National Health Insurance (NHI) which aims to provide universal health coverage to the South African population. The audits revealed poor infrastructure, excessive waiting times, medicine shortages and overall patient dissatisfaction resulted in poor usage of services.[12] To address these challenges, the Office of Health Standards Compliance (OHSC) was established under the National Health Amendment Act of 2013 to oversee the Ideal Clinic Realisation and Maintenance (ICRM) programme. Public dental clinics in the Western Cape Metro (WCM) have been included in the ICRM facility audits since its implementation but very little has been done to address areas that are not "ideal", specifically in terms of essential equipment. Audits reflect necessary resources are available; however, the services provided to the public does not reflect this. A facility with ideal status has "*good infrastructure (ie physical conditions and spaces, essential equipment and information and communication tools), adequate staff, adequate medicines and supplies, good administrative processes and adequate bulk supplies*.[12]

A study by Smit and Osman revealed less than a third (31.5%) of public dental clinics in the Western Cape offered the basic treatment package and less than two-thirds (65%) were only offering treatment for pain and sepsis in the form of tooth extractions.[5]

In light of the above-mentioned challenges, the aim of the study was to conduct an assessment of available instruments, equipment and materials in public dental clinics in the WCM and evaluate their compliance with the Primary Healthcare Package for South Africa.

METHODOLOGY

Ethical approval was obtained from the Research Ethics Committee of the Faculty of Health Sciences, University of Pretoria (Ref: 57/2023). Access to public dental clinics was applied for via the National Health Research Database (NHRD). Approval letters were issued via the Western Cape Department of Health and Wellness Health Support directorate. The researcher was unable to contact potential participants directly. No personal details of the participants were disclosed and all information was strictly confidential and anonymous.

A quantitative, cross-sectional study auditing public dental clinics in the Western Cape metro area was conducted. All 28 public dental clinics in the Western Cape metro area were invited to complete a survey to achieve the objectives of the study. Participants were in full-time employment at the dental clinic.

Each participant received an information leaflet and consent form to read and sign if they agreed to participate in the study. A self-administered questionnaire drawn up with Microsoft Word was used to collect data. The questions were taken from the Primary Healthcare Package for South Africa: A Set of Norms and Standards.[7] The questionnaire was distributed to a dental clinic staff member and included closed-ended questions about the presence of key staff members such as dentists, dental therapists, dental assistants, oral hygienists and receptionists. Additionally, it inquired about the availability of various dental services, requesting information on the hours dedicated to each service and barriers preventing their delivery.

The oral health checklist in the Ideal Community Health Centre Definitions, Components and Checklists document was adapted to suit the requirements of the study**.** The study checked and recorded the available dental equipment, instruments and consumables in the dental clinic. Additionally, the relevant staff member verified whether each item was actively in use. In cases where an item was not yet available but had been ordered, an anticipated delivery date was provided.

DATA ANALYSIS

Data analysis was done with SPSS version 28. Quantitative variables were summarised as proportions, frequencies and means with their standard deviations, ranges and percentages. A Chi-square test was used to evaluate the association between variables – the level of significance was set at $p \leq 0.05$. The missing data was omitted during the data analysis.

RESULTS

A total of 15 clinics responded out of the 28 invited with a response rate of 53.6%.

Table 1. Services offered in the PHC facilities n=15

Service	n(%)	Service	n(%)
Oral hygiene education	15(100)	Scaling & Polishing	9(60)
Treatment of pain & sepsis	15(100)	Intra-oral x-rays	3(20)
Fissure sealants	10(66.7)	1-3 surface fillings incl ART	11(73.3)
Topical fluoride	14(93.3)	Outreach services eg schools	14(93.3)

Only two clinics offered all of the services outlined in the basic package of care.

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Table 2. Equipment in PHC facilities n=15

Equipment	n (%)	Equipment	n (%)	Equipment	n (%)
Amalgam separator	0(0)	Dental scaler	14(93.3)	X-ray: wall mounted	8(53.3)
Amalgamator	12(80)	Headband light	7(46.7)	X-ray: digital oral imaging plate with computer and cabling	0(0)
Autoclave	15(100)	Paediatric booster seats	0(0)	3-in-one syringe incl. dental delivery system	15(100)
Compressor	13(86.7)	Plastic dental instrument trays	14(93.3)	Air motor (high speed turbine)	15(100)
Cuspidor	13(86.7)	Stool: dentist	14(93.3)	Contra-angle handpiece	14(93.3)
Dental chair basic	15(100)	Stool: dental assistant	14(93.3)	Slow handpiece	15(100)
Dental delivery system with handpieces (fixed)	13(86.7)	Suction: central, wet/dry	12(80)	Slow handpiece motor	15(100)
Dental delivery system with handpieces (mobile)	2(13.3)	Suction: mobile	2(13.3)	Straight handpiece	15(100)
Dental LED light	15(100)	Ultrasonic cleaner	4(26.7)		
Dental curing light	15(100)	Water distiller	12(80)		

Oral hygiene education and treatment of pain and sepsis were universally available in all 15 clinics. Outreach services, including those provided in schools, as well as topical fluoride applications, were offered by 93.3% of the clinics. Services like intra-oral X-rays and scaling and polishing were less universally available, offered by 20% and 60% of the clinics, respectively. Fissure sealants and 1-3 surface fillings, including ART, were available in 66.7% and 73.3% of the clinics, respectively. Certain equipment was nearly universal across these clinics, with all 15 clinics having essential items such as autoclaves, basic dental chairs, three-in-one syringe systems, slow handpieces and straight handpieces. Air motors (high-speed turbines), dental LED lights, dental curing lights, plastic dental instrument trays, dental scalers and contra-angle handpieces were observed in 100% of the surveyed clinics. Conversely, items such as amalgam separators, paediatric booster seats and X-ray systems with digital oral imaging plates and associated cabling were notably absent in all clinics. None of the clinics had all of the equipment to offer outreach treatment services. Only two of the clinics had mobile dental delivery units but no central suction systems. One clinic did not have a compressor. Only 11 clinics had 80% or more of the required equipment.

Ten clinics had 80% or more of the 30 required instruments used to treat pain and sepsis.

Table 3. Instruments in PHC facilities n=15

Instrument	n (%)	Instrument	n (%)	Instrument	n (%)
Cryers left	15(100)	Forceps: tooth extracting lower molars	14(93.3)	Forceps: tooth extracting upper roots 29	12(80)
Cryers right	15(100)	Forceps: tooth extracting lower roots and crowded incisors	14(93.3)	Forceps: tooth extracting lower teeth and roots, child	9(60)
Straight large	14(93.3)	Forceps: tooth extracting upper roots 44N	12(80)	Forceps: tooth extracting lower canines, adult	13(86.7)
Straight medium	14(93.3)	Forceps: tooth extracting upper roots 29 S	13(86.7)	Forceps: tooth extracting lower anterior, adult	14(93.3)
Straight small	15(100)	Forceps: tooth extracting upper roots 76	13(86.7)	Forceps: tooth extracting upper incisors and canines, child	10(66.7)
Warwick-James left	15(100)	Forceps: tooth extracting upper roots small	10(66.7)	Forceps: tooth extracting upper molars, child	10(66.7)
Warwick-James right	15(100)	Forceps: tooth extracting lower molars child	11(73.3)	Forceps: tooth extracting upper teeth and roots, molars, child	6(40)
Warwick-James straight	14(93.3)	Forceps: tooth extracting upper anterior and canines	15(100)	Forceps: cheatle	9(60)
Forceps: tooth extracting upper molars left	15(100)	Forceps: cheatle container/ holder	1(6.7)	Forceps: tooth extracting upper molars right 90	14(93.3)
Forceps: tooth extracting lower bicuspids	13(86.7)	Forceps: tooth extracting upper molars right 89	13(86.7)		

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Table 4. Conservative instruments in PHC facilities n=15

Instrument	n (%)	Instrument	n (%)	Instrument	n (%)
Amalgam carrier plastic right angle	8(53.3)	Cotton pellet holder	12(80)	Kidney dishes small	11(73.3)
Amalgam carrier plastic straight	8(53.3)	Cotton wool holder (small bowl)	14(93.3)	Matrix retainer Siqveland Narrow/ Tofflemire	10(66.7)
Amalgam carver	10(66.7)	Dappen dishes	15(100)	Matrix retainer Siqveland Wide/ Tofflemire	9(60)
Amalgam plugger	11(73.3)	Dental Explorers/ Probes Straight	15(100)	Mouth Mirrors to it Handle Mouth Mirror	15(100)
Ball burnisher 2.5-3.0mm	15(100)	Dental syringe Aspirating	15(100)	Mouth models	15(100)
Bib holders	5(33.3)	Excavator 125/126	12(80)	Needle holder	13(86.7)
Bur blocks	15(100)	Excavator 129/130	12(80)	Sickle	6(40)
Bur brushes	12(80)	Excavator 133/134	14(93.3)	Tofflemire holder	13(86.7)
Cement spatula	15(100)	Flat plastic	15(100)	Thymosin	13(86.7)
Chip syringe	9(60)	Handle Mouth Mirror	15(100)	Waste receiver	8(53.3)
Cotton and dressing Tweezers	14(93.3)	Kidney dishes large	12(80)		

Instruments such as ball burnishers (2.5-3.0mm), bur blocks, cement spatulas, handle mouth mirrors, and mouth models were universally present in all clinics. Dental syringes (aspirating) and dental explorers/probes (straight) were also universally available. Some instruments showed varying levels of availability. For instance, amalgam carriers, both in plastic right-angle and straight configurations, were present in approximately 53.3% of clinics. Similarly, bib holders and sickles demonstrated lower levels of prevalence, found in 33.3% and 40% of clinics respectively.

Instruments such as matrix retainers (Siqveland Narrow/ Tofflemire and Siqveland Wide/Tofflemire) and thymosin displayed mid-range prevalence, indicating that they are relatively common but not ubiquitous. On the other hand, instruments such as kidney dishes (both small and large) and waste receivers were found in 73.3% to 80% of clinics.

Table 5. Periodontal instruments in PHC facilities n=15

Instrument	n (%)
Dental probe: periodontal	15(100)
Periodontal hoe SG 5F	10(66.7)
Scaler, dental: H6/7	10(66.7)

The dental probe specialised for periodontal examinations was found to be universally present across all 15 clinics. The periodontal hoe SG 5F and dental scaler H6/7 were available in 66.7% of the clinics.

Table 6. Miscellaneous instruments in PHC facilities n=15

Instrument	n (%)	Instrument	n (%)
Artery forceps	12(80)	Slab: mixing, glass	14(93.3)
Handle scalpel	13(86.7)	Tongue forceps	7(46.7)
Mouth gag	12(80)	Trimmer: gingival margin U3/U4	7(46.7)
Protective glasses	14(93.3)	Trimmer: gingival margin Ui/U2	6(40)
Rongeur: dental No.4	15(100)	Wire ligature forceps	6(40)
Rongeur: dental No. 5S	9(60)	Apron, dental, plastic, adult	14(93.3)
Scissors, ligature	12(80)	Apron, dental, plastic, child	4(26.7)

Dental artery forceps and mouth gags were present in 80% of the clinics. Protective glasses and ligature scissors were available in a majority of clinics, with rates of 93.3% and 80%, respectively. On the other hand, instruments such as tongue forceps, U3/U4 gingival margin trimmers, Ui/U2 gingival margin trimmers and wire ligature forceps showed comparatively lower availability rates, suggesting these instruments may not be as universally utilised across all surveyed clinics. Dental aprons, particularly those designed for adults, were prevalent in 93.3% of the clinics; however, aprons for children were less commonly available, found in only 26.7% of clinics.

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Table 7. Consumables for exodontia and minor oral surgery clinics that responded n=15

Consumable	n (%)	Consumable	n (%)	Consumable	n (%)
Surgical blades No.11 &12	13(86.7)	Haemostat sponge	14(93.3)	Sutures, surgical	14(93.3)
Chlorhexidine oral rinse 0.2%	15(100)	Hydrogen peroxide	4(26.7)	Topical anaesthetic	11(73.3)
Cotton wool balls	15(100)	Hypodermic needles	15(100)	Local anaesthetic (with and without vasoconstrictor)	15(100)
Dry socket alveolar paste	12(80)	Saline solution, 500ml	11(73.3)		
Ethyl chloride	6(40)	Saliva ejectors, disposable	15(100)		

Certain consumables exhibited a remarkably high presence, with items such as chlorhexidine oral rinse (0.2%), cotton wool balls, disposable saliva ejectors, hypodermic needles and local anaesthetics (both with and without vasoconstrictor) universally available in all 15 clinics. Haemostat sponges and surgical sutures were found in 93.3% of clinics. Dry socket alveolar paste was found in 80% of clinics and saline solution (500ml) was available in 73.3% of clinics.

Table 8. Consumables for conservative dentistry clinics that responded n=15

Consumable	n (%)	Consumable	n (%)	Consumable	n (%)
Fissure sealants	14(93.3)	Prophylaxis paste	14(93.3)	Glass ionomers	12(80)
Amalgam capsules	7(46.7)	Cement/Liners (Kalzinol/ Dycal)	13(86.7)	Polishing strips	15(100)
Composite	14(93.3)	Articulating paper	15(100)	Polishing kit	9(60)
Fluoride gel	14(93.3)	Cotton wool pellets	13(86.7)	Dental floss	14(93.3)
Varnish cavity liner	5(33.3)	Polyester strips (composite)	15(100)	Fluoride trays	14(93.3)
Acid etch & bonding agent	14(93.3)	Toothpaste, fluoridated	13(86.7)	Toothbrushes	13(86.7)

Polishing strips, articulating paper and polyester strips (composite) were universally available in all 15 clinics. Fissure sealants, prophylaxis paste, composite, fluoride gel and dental floss also exhibited high availability, present in 93.3% of the surveyed clinics. On the other hand, varnish cavity liner displayed a lower availability rate of 33.3%, indicating it may not be as commonly used in these clinics. Items such as amalgam capsules, cement/liners (Kalzinol/Dycal) and polishing kits showed varying levels of prevalence.

Participants reported that the Covid-19 pandemic guidelines recommended the suspension of elective dental treatment maintaining only emergency dental appointments. Many instruments and equipment were no longer in use and deteriorated due to lack of maintenance. Consumables were not replenished and most items reached their expiration dates. This impacted dental clinics' ability to offer preventative and restorative treatments. All clinics engaged in school outreach services and collaborated with various other institutions to promote oral health.

DISCUSSION

The response rate of this study was 53.6%, which could be due to the high patient volumes seen at PHC clinics which limited the time the respondents had available for research participation. Similar studies that surveyed oral health care professionals reported similar response rates.[13,14] Additionally, concerns about potential exposure of shortcomings may have contributed to the lower response rate.

Services

The number of surveyed clinics offering the basic package of care was much lower than the findings reported in a previous study.[5] This likely stems from the fact that dental clinics lack access to a fundamental set of equipment, instruments and consumables necessary for performing the basic recommended services. While all clinics offered treatment for pain and sepsis, approximately two-thirds provided preventative treatments. The substantial burden of untreated dental caries, coupled with delayed treatment seeking in the Western Cape, amplifies the demand for dental extraction services.[5] All clinics remained actively engaged in school outreach services and collaborated with various institutions to promote oral health, demonstrating a strong commitment to community-based oral healthcare.

Equipment

The study highlights crucial gaps in equipment availability that warrant immediate attention. One noteworthy shortfall is the absence of X-ray systems, which poses a significant constraint on diagnostic capabilities. This limitation has the potential to impede accurate diagnoses and treatment planning, potentially compromising the quality of care provided.[15] Furthermore, the observation that none of the clinics possess all the necessary equipment for outreach services underscores a potential deficiency in community-based dental care provision. This suggests that there may be challenges in delivering comprehensive dental services to communities beyond the clinic premises. Another critical

aspect is the absence of amalgam separators, signifying potential environmental and waste management gaps. These separators are essential for responsible dental practice, as they help prevent the release of harmful substances into the environment.[16]

The presence of only two clinics in the study equipped exclusively with mobile dental delivery units and lacking central suction systems draws attention to a crucial infrastructure issue. These mobile units can be instrumental in expanding the reach of dental care, especially to remote or underserved areas. However, the absence of central suction systems could potentially hinder the standardisation of clinical operations and compromise the overall quality of care provided. To address this challenge, it is imperative to consider further investments in infrastructure within the dental healthcare system.

Consumables

The study reveals a mixed landscape of availability for dental consumables across the surveyed clinics. Items such as fissure sealants, prophylaxis paste, composite, fluoride gel and dental floss exhibited high availability, although services suggest these are not optimally utilised. Participants highlighted that the Covid-19 pandemic brought about significant shifts in dental practice guidelines, emphasising the suspension of elective dental treatments and prioritising emergency appointments. Consumables were not replenished, and a majority of items reached their expiration dates.

Instruments

The study's findings reveal that the majority of clinics were adequately equipped with the necessary dental instruments for a diverse range of clinical procedures. However, it is noteworthy that less than half of the clinics possessed the instruments essential for performing amalgam restorations, potentially suggesting a shift towards a preference for more aesthetic restorative treatments.

This shift aligns with the recommendations of the Minamata Convention on Mercury, which advocates for reducing the use of dental amalgam due to environmental and health concerns.[16] The lower prevalence of periodontal instruments correlates with the low availability of oral hygiene treatment services. This indicates that clinics may be prioritising curative measures over basic oral hygiene care.

CONCLUSION

The assessment of instruments and consumables reveals a generally high level of preparedness in the surveyed clinics. However, none of the clinics was compliant with national norms and standards.[7] There are notable gaps and variations that should be addressed to ensure consistent and comprehensive oral healthcare services across all clinics.
This information provides a valuable foundation for strategic planning, resource allocation and training initiatives to further enhance the capabilities of these primary healthcare facilities.

Limitations

The cross-sectional design of this study imposes limitations on the ability to infer causality. Only 15 of the 28 clinics volunteered to participate in the study. Participants were recruited via the Western Cape Department of Health and Wellness Directorate Health Support and the researcher was not able to follow up with or recruit participants directly.

RECOMMENDATIONS

Clinics can use these findings to prioritise the procurement of missing equipment and instruments, ensuring they have the necessary resources to meet the demands of their patient population.
Understanding the current state of resources and services allows for evidence-based policy-making to improve overall oral health outcomes in the region.

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Conflict of interest

None.

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The description of diagnosed cases of oral epithelial dysplasia at the Tygerberg Oral Health Centre

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NC Nkomo,[1] A Jeftha,[2] F Kimmie-Dhansay,[3] J Opperman[4]

ABSTRACT

Oral epithelial dysplasia (OED) is a growth anomaly which occurs due to atypical proliferation, change in the architectural and cytological features of cells of epithelial origin, resulting in the formation of a lesion with disturbed differentiation and maturation.

The purpose of this study was to describe the OED cases diagnosed at Tygerberg Hospital in a seven-year period (from 2012 until 2019) and to determine the demographics and clinical location of these cases. The patients' medical records from the National Health Laboratory Service (NHLS) were reviewed. All diagnosed cases of OED were identified, and the data retrieved for further assessment and comparison.

Seventy cases of OED were diagnosed in the period assessed. Of those cases, the median age was 58 and the interquartile range was between 48 and 62. Thirty-six of the diagnosed patients were female and 34 were male. Most of the lesions diagnosed with OED were found on the tongue, floor of the mouth and buccal mucosa. Majority of the mild cases of OED existed in smokers (59.4%) and non-alcohol consumers (60%); however, there was no association between smoking (p=0.607) and OED severity. There was a statistically significant association between alcohol consumption and OED severity (p=0.021) (Table I).

From the results, it was derived that majority of the cases were mild and the most common location was on the tongue. Moreover, there was an association between alcohol consumption and OED severity (p=0.021).

Authors' information
1. Dr Nocwaka Charlotte Nkomo, *BChD*, *PG dipl*. aesthetic dentistry, *Msc* Oral medicine (UWC), Junior dentist, Department of Oral Medicine and Periodontology, University of the Witwatersrand, Johannesburg, South Africa
   ORCID: 0009-0007-3854-1696
2. Prof Anthea Jeftha, *BChD*, *MChD* (Oral Medicine and Periodontology) (UWC), Department of Oral Medicine and Periodontology, Faculty of Dentistry, University of the Western Cape, Cape Town, South Africa
   ORCID: 0000-0003-0910-5899
3. Dr Faheema Kimmie-Dhansay, Department of Community Dentistry, Faculty of Dentistry, University of the Western Cape, Cape Town, South Africa
   ORCID: 0000-0003-2919-6193
4. Dr Johan Opperman, Department of Craniofacial Biology, Pathology and Radiology, Faculty of Dentistry, University of the Western Cape and NHLS
   ORCID: 0000-0002-9684-6670

Corresponding author
Name: Dr N Nkomo
Email: nocwaka.nkomo1@wits.ac.za

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Oral epithelial dysplasia, oral potentially malignant disorders, degree of dysplasia, oral squamous cell carcinoma

INTRODUCTION

Oral potentially malignant disorders (OPMDs) are defined by the WHO Collaborating Centre for Oral Cancer Workshop in 2020 as "any oral mucosal abnormality that is associated with a statistically increased risk of developing oral cancer". The term embraces precancerous lesions and conditions referred to in earlier World Health Organization (WHO) definitions.[1]

Some OPMDs may present with oral epithelial dysplasia (OED), and it has been widely used as a marker for risk assignment, in the prediction of malignant transformation and, consequently, the prognosis of OPMDs. The common lesions that may present with OED include, but are not limited to, oral submucous fibrosis, oral leukoplakia, erythroplakia, palatal lesions in reverse smokers, proliferative verrucous leukoplakia, lichen planus, discoid lupus erythematosus, actinic chelitis and certain genetic disorders, for example Xeroderma pigmentosum and Dyskeratosis congenita.[2]

The prevalence of OED is infrequently reported. In a retrospective study by Singh et al 2020 the mean prevalence of OED in the Indian population was 5.7%, while a study by Hsue et al 2007 reported a rate of 8.85% in the Taiwan population.[3,4] The variation in this reported prevalence could be attributed by variable risk behaviour across different geographic locations.[5] A retrospective study of 173 cases by Pereira et al 2011 from Brazil reported a rate of 1.8%.[5]

Most oral cancers are preceded by potentially malignant disorders; 50% of all cancers develop from precursor lesions.[7] The five-year survival rate of oral cancers in most countries is below 50%.[6] This high failure rate is due to the delay in the diagnosis and the emergence of secondary tumours.[6] Enhancing understanding of the progressive, multistep genetic changes involved in tumour formation, invasion and metastasis, as well as raising awareness about the epidemiology of OED and OSCC, is crucial. It is equally important for clinicians to identify, diagnose and monitor OPMDs, which can lead to more effective treatment plans, ultimately reducing mortality and improving quality of life.[7]

Aims and objectives

This cross-sectional study aimed to describe OED cases over a seven-year period and analyse the link between the clinical appearance of the cases with other factors such as patient demographics and risk indicators.

Design, materials and methods

This cross-sectional study analysed all OED diagnoses at Tygerberg Hospital National Health Laboratory Service between 2012 and 2019. All cases of diagnosed OED were identified, and the files of patients seen at UWC Faculty of

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Dentistry, Oral Health Centre were retrieved. The individual medical records were assessed. All patients who were diagnosed with OED by an oral pathologist between 2012 and 2019 were included in this study. Patients previously diagnosed with head and neck cancer and those with incomplete data were excluded.

The following data were extracted from pathology reports and available patient files – OED grading, the patients' demographics (age and sex), smoking and drinking habits, relevant clinical information which included the date of diagnosis and location of lesion.

The pathology diagnosis for the OED cases was done by different oral pathologists. A smoker was defined as one who smoked tobacco cigarettes at the time of diagnosis, and an alcohol user was defined as any individual who consumed alcoholic beverages, regardless of the frequency and type. The age referred to the chronological age, recorded in years. Age was presented across four groups (<44, 45-54, 55-64, >65 years) for easier reporting. The grading of OED was done using the WHO 2017 classification. The three-tier WHO 2017 classification classifies dysplasia into mild, moderate and severe. In mild dysplasia, the architectural and/or cytological changes are confined to the lower third of the epithelium, while moderate dysplastic changes extend to the middle third of the epithelium and severe dysplastic changes extend beyond the middle third and may affect the entire epithelial thickness.[1]

Summary statistics was performed using frequencies and percentages. Associations between the variables were performed using a Chi-squared or Fishers' exact test. A multinomial regression was performed to detect associations between risk indicators and the severity of OED. All tests were deemed statistically significant at $p<0.05$. All statistical tests were conducted using StataCorp. 2017. Stata Statistical Software: Release 15. College Station, TX: StataCorp LLC.

Approval to conduct this study was obtained from the Biomedical Research Ethics Committee of the University of the Western Cape, BM19/10/4 and from the NHLS.

Results

Overall, 99 cases of OED were diagnosed in the 2012 to 2019 period. However, 29 cases were excluded due to incomplete data (smoking history, missing files or incomplete information in the file). Only 70.7% (n=70) of the overall cases were analysed. The median age of the participants was 58, with an interquartile range from 48 to 62. The youngest participant was 11 and the eldest was 82. OED was classified as mild (40 (57.1%)), moderate (19 (27.1%)) or severe (11(15.7%)). The WHO 2017 classification was used in the grading.

Table I: Degree of oral epithelial dysplasia and various factors

		DEGREE				
		MILD	MODERATE	SEVERE	Total	p-value
Sex	Female	21 (58.3)	10 (27.8)	5 (13.9)	36 (51.4)	0.911
	Male	19 (55.9)	9 (26.5)	6 (17.7)	34 (48.6)	
Age category	<44	11 (73.3)	3 (20)	1 (6.7)	15 (21.4)	0.246
	44-54	13 (68.4)	2 (10.5)	4 (21.1)	19 (27.1)	
	55-64	9 (45)	7 (35)	4 (20)	20 (28.6)	
	65+	7 (43.75)	7 (43.8)	2 (12.5)	16 (22.9)	
Location	Alveolar ridge	1 (50)	0 (0)	1 (50)	2 (2.9)	0.683
	Buccal mucosa	10 (71.4)	3 (21.4)	1 (7.1)	14 (20.0)	
	FOM	4 (50)	2 (25)	2 (25)	8 (11.4)	
	Gingiva	2 (50)	2 (50)	0 (0)	4 (5.7)	
	Lower lip	4 (80)	1 (20)	0 (0)	5 (7.1)	
	Maxilla	0 (0)	0 (0)	1 (100)	1 (1.4)	
	Oral mucosa	2 (50)	2 (50)	0 (0)	4 (5.7)	
	Palate	1 (50)	1 (50)	0 (0)	2 (2.9)	
	Retromolar area	1 (50)	1 (50)	0 (0)	2 (2.9)	
	Tongue	14 (51.9)	7 (25.9)	6 (22.2)	27 (38.6)	
	Upper lip	1 (100)	0 (0)	0 (0)	1 (1.4)	
Alcohol	N	27 (60)	15 (33.3)	3 (6.7)	45 (64.3)	0.021
	Y	13 (52)	4 (16)	8 (32)	25 (35.7)	
Smoker	N	21 (55.3)	12 (21.6)	5 (13.2)	38 (54.3)	0.607
	S	19 (59.4)	7 (21.9)	6 (18.8)	32 (45.7)	

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There were 51.4% (n=36) females, and the majority of the participants were older than 44 years of age. The most common location was the tongue, the exact location on the tongue was not specified. Almost 36% (n=25) were alcohol consumers and almost 46% (n=32) were smokers. There was no statistically significant association between degree of OED and age ($\chi2 = 0.946$), sex ($\chi2 = 0.1866$), alcohol usage ($\chi2 = 0.021$) or age category ($\chi2 = 0.561$).

Table II: Degree of oral epithelial dysplasia diagnosis by risk indicators

Degree	Odds ratio (95% Confidence Interval)	p>z	95% conf. interval	
Smoker Yes	0.756 (0.26 to 2.24)	0.613	0.255	2.236
Sex Male	0.966 (0.4 to 2.28)	0.949	0.339	2.751
Alcohol Yes	2.026 (0.7 to 5.94)	0.198	0.691	5.940
Age 44-54	1.309	0.731	0.283	6.051
55-64	3.079	0.127	0.726	13.069
65+	2.366	0.264	0.522	10.729
/cut 1 /cut 2	1.001 2.478		-0.208 1.146	2.210 3.811

There was no association between smokers, non-smokers and OED degree OR 0.756 (0.26-2.2.4). There was no association between sex and OED degree OR 0.966 (0.4-2.28). There was also no association between alcohol usage and age category.

For subjects who are in the 55-64 year age group relative to subjects who are below 44, the OR for moderate and severe dysplasia to mild dysplasia would be expected to increase by a factor of 3.079.

The tongue has the highest prevalence at 27 (38.57%), followed by the buccal mucosa at 14 (20%), then the FOM at 8 (11.43%). The upper lip and maxilla presented the least frequently with OED of 1 (1.43%) each. The tongue presented with the highest number of cases, but the three degrees of dysplasia was equally represented ($\chi2=0.683$).

Forty-five (64.3%) of the patients did not consume alcohol while 25 (54.3%) of the patients consumed alcohol. Therefore, there were more non-alcohol consumers diagnosed with OED than alcohol consumers. Thirty-eight (54.29%) of cases were found in non-smokers while smokers had 32 (45.71%) of the cases.

DISCUSSION

The difficulty of accurately classifying and diagnosing OED has been repeatedly highlighted and identified as an inherent limitation of any OED study.[2,3,7,9-11] The inconsistencies among observers and within the same observer are largely due to the challenges of accurately classifying and diagnosing OED, as pathologists' evaluation of specimens depend heavily on their training and past experiences.[8] The validity, uniformity and reproducibility is therefore affected. Most pathologists are familiar with the WHO 2005 grading system; this interferes with correlative accuracy and subjective judgment.[9,10] The current data set was diagnosed by various oral pathologists and hence no inter or intra observer calibration could be conducted due to the retrospective study design.

Moreover, the lack of reproducibility and consistency affects the predictive and prognostic value of grading OED. Inadequate biopsy sampling and cytological alteration due to sampling methods also affects the grading. Field mapping, the use of blade biopsies and taking multiple biopsies have been suggested to overcome this.[9-11]

The WHO 2017 and binary systems (which categorises OED into high risk and low risk) are the most reproducible systems when used between calibrated pathologists. It has also been suggested that continuous and ongoing calibration and consensus meetings, the merging of severe OED and carcinoma in situ categories, holding internal and external quality assurance programmes and the use of single centre design for OED-related studies can help improve reproducibility.[9-11]

In our study OED cases peaked in the fifth and sixth decades and had a female predilection. The age peak differs from most studies except that of Mincer et al, 2020 which reported a similar peak pattern.[3] The sex predilection of OED is consistent with the study done by Pereira et al, 2011, but in contrast with most studies that reported a male predilection.[5]

In a study of South African-related cancer statistics between 2008 and 2018, the cancer incidence was found to have reduced in the above-mentioned period; however, the associated mortality rate seems to be rising.[12] It is therefore important for clinicians to continually screen patients they see daily to allow for early detection and treatment, therefore improving the cancer-related morbidity and mortality rates. According to Stats SA, in 2018 the lip, oral cavity and pharynx accounted for 2.6% of all malignancies.[12]

Alcohol and smoking are known risk factors for the development of oral squamous cell carcinoma and have a synergistic effect when combined.[8] However, alcohol consumption does not appear to be an independent risk factor. The risk of OED development declines with smoking cessation.[8]

In our study, there were no statistically significant associations with smoking or with alcohol. In the literature, there are inconsistent results, with both negative and positive relationships.[13,14] This has led to the conclusion that the relationship between alcohol and OED, therefore, is not well established. The risk associated then depends on the level of alcohol consumption; the type of alcohol is irrelevant.[13,14] This is a limitation of our study, as the level of alcohol consumption was not measured.

Forty-one percent of patients with OED were identified as non-smokers and non-alcohol consumers. This was much higher than the 4.4% reported by Farshadpour et al, 2007.[15] Wey et al, on the other hand, reported a much higher figure at 31%[16] – this was, however, still lower than our study.

Human papillomavirus (HPV) infection is well known to be associated with head and neck cancers. HPV-associated head and neck cancers are related to sexual behaviour.[17]

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The prevalence of oral and oropharynx HPV infections has been studied globally, but there is a lack of substantial data from sub-Saharan Africa, specifically South Africa.[18] There is an increasing trend of HPV associated cancers among young individuals; there is, therefore, a need for general public awareness programmes and clinician-based patient education on the link between sexual behaviour, high risk HPV transmission and cancer development.[21]

The use of potentially carcinogenic leaf products such as areca nut, with/or without tobacco, adds to the complexity of aetiological factors for oral cancer in South Africa. It has been reported that up to 93% of adult South African Indian women chew areca nut/quid.[23]

Despite advances in research and surgical techniques, the five-year survival rate for OSCC remains low, with a rough estimate of 50%.[19,20] The high morbidity and mortality rates emphasise the importance of routine systematic extraoral and oral mucosal examinations in dental practices, screening programmes and techniques for early detection of malignancy. Although screening programmes have been highly criticised and often found to be ineffective, they have good outcomes in poor health resourced areas.[21]

Routine oral mucosal examinations should place an emphasis on the systemic tactile and visual oral examination, the use of adequate illumination (bright light), proper use of the dental mirror, retraction of the tongue and adequate prompt referrals should any abnormalities be detected.[21,22] Clinicians should be on the lookout for change in colour and soft tissue texture and consistency, the presence of high risk OPMDs, altered taste and non-healing ulcers. The presence of patient associated risk factors such as smoking, alcohol consumption, betel nut chewing, family history of oral cancer and chronic sun exposure should also be considered. By remaining vigilant about these clinical features and monitoring high risk lesions, clinicians can significantly contribute to the early detection and management of OPMDs.[21,22]

Rigorous follow-up of patients diagnosed with oral epithelial dysplasia is essential to assess for malignant transformation, early detection and intervention.[19,20] Early diagnosis and intervention, in turn, improves the overall life expectancy and quality of life due to less invasive treatment regimes.[19,20] Moreover, South Africa has a major health disparity challenge. Approximately 20% of the population has access to private medical care, while 80% of the population uses public (government) healthcare facilities.[12] The public sector system is therefore overburdened. Currently, most patients present quite late[19,20] and those diagnosed with OED do not follow rigorous follow-up protocols because this follow-up is often difficult in resource poor settings and among patients who hail from resource constraint backgrounds. This also poses diagnostic challenges and the implementation of screening programmes due to lack of resources.

A mobile health platform (VULA app) was created in South Africa to link health care workers with specialists, facilitate screening, encourage early and timely referrals and, ultimately, support early diagnosis and improved prognosis outcomes. However, majority of healthcare workers are not using the platform.

Although our study did not link OED development to risk indicators, the study came with limitations and the role that risk factors play in the development of OED cannot be ruled out. There is, therefore, a need for effective preventive measures and public health interventions to educate the community about the importance of prevention, limiting exposure to risk factors and the importance of follow-up visits. Moreover, oral health promotion can help increase screening and facilitate earlier detection of lesions.

CONCLUSION

Despite the decrease in the number of diagnosed OSCC cases, the mortality rate remains high in South Africa. There is, therefore, a need for more studies on associated risk factors, especially the prevalence of the highly rising oral and oropharynx HPV infections. The public and health care practitioners need to be educated on the importance of early detections of OPMDS, with rigorous follow-up to allow for assessment of malignant transformation and early intervention.

Declaration

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Conflict of interest

There are no conflicts of interest

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Pathogens associated with contamination in dental clinics: Evaluating emerging threats with a focus on mpox

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R Ahmed[1], S Ahmed[2]

INTRODUCTION

The presence of various pathogenic agents in healthcare settings, especially dental clinics, presents significant challenges for infection control and patient safety. This review explores the diverse range of pathogens associated with dental surface contamination, including well-established pathogens and the recently reported monkeypox (mpox) outbreak.

Aims and objectives

The primary aim of this review is to offer a comprehensive overview of the existing literature on pathogens linked to surface contamination in the dental environment. The objectives are to:

1. Examine the transmission dynamics of various pathogens in dental clinics.
2. Assess the role of saliva in microbial dispersion and the impact of dental procedures on the aerosolisation of viruses, bacteria and fungi.
3. Evaluate environmental contamination risks associated with these pathogens.

Methods

The review involves an analysis of existing studies that examine the presence and transmission of pathogens in dental settings. It includes a detailed examination of the characteristics of viruses, bacteria, fungi and the impact of aerosol-generating procedures on the spread of these microorganisms.

Results

The review highlights the significant risks posed by surface contamination in dental clinics, particularly in relation to the aerosolisation of pathogens during dental procedures. It synthesises data showing that dental environments can become reservoirs for pathogens, contributing to nosocomial infections.

Conclusions

This review underscores the need for updated guidelines and enhanced surveillance to address the risks associated with surface contamination in dental clinics.

Authors' information
1. Rukshana Ahmed, *BChD*, *PDD*, *MSc*, Department of Prosthodontics, Faculty of Dentistry, University of the Western Cape, South Africa
ORCID: 0000-0002-0286-9047
2. Dr Suwayda Ahmed, *BChD*, *PDD*, *MSc*, Senior Lecturer, Restorative Dentistry, Faculty of Dentistry, University of the Western Cape, South Africa
ORCID: 0000-0001-8174-6928

Corresponding author
Name: Dr S Ahmed
Email: suahmed@uwc.ac.za
Tel: (021) 937 3091

Author's contribution
Dr S Ahmed – writing of article (100%)

Conflict of interest
The author declares there is no conflict of interest.

Pathogen transmission

The transmission of pathogens in dental clinics poses a significant risk to both patients and healthcare professionals, especially during aerosol-generating procedures (AGPs). The close proximity required for dental treatments, in addition to the frequent use of high-speed instruments, facilitates the spread of infectious agents through aerosols and surface contamination. While established pathogens such as bacteria, viruses and fungi have long been recognised as possible sources of nosocomial infections, the recent emergence of novel threats such as monkeypox,[1] now referred to as mpox, highlights the need for updated infection control protocols and enhanced vigilance in dental practices.[2-4]

Role of saliva in surface contamination

Saliva plays a pivotal role in maintaining oral homeostasis and harbours essential biological constituents necessary for oral health and acts as a reservoir for microorganisms.[5-7] Saliva contributes to the immune defence against bacterial, fungal and viral infections. In doing so, it maintains the integrity of both hard and soft tissue. This diverse microbiota can include both beneficial and pathogenic microorganisms. The composition of the oral microbiota within saliva is influenced by various factors such as dietary habits, smoking, age, oral hygiene practices, dietary practices and systemic conditions.[8-10] The presence of these microorganisms and the interactions among each other has a pivotal role in maintaining oral health. Under certain circumstances the change in the equilibrium within the oral cavity can result in the development of oral diseases that may result in contamination when aerosolised. Dental healthcare workers face occupational health risks due to their close proximity to the oral cavity and exposure to aerosols generated during procedures.[7,11,12]

Aerosol formation

During AGPs aerosols is formed primarily due to the large volume of water that is necessary to prevent trauma or damage to the tooth structure during dental procedures. As a result of the mechanical contact between the instrument and the tooth, saliva, biological tissue or blood, aerosolised

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particles of varying sizes are formed.[12,13] Aerosol particles contaminated with biological matter such as bacteria, viruses or fungi are known as bioaerosols.[11] AGPs using high speed dental instrumentation are the principal source of bioaerosols, as indicated by the elevated particle concentrations during the dental procedures in comparison to baseline assessments of air contamination.[11,12,14] AGPs are especially concerning because it results in aerosols small enough (less than 5 microns) to remain suspended in the air for extended periods, increasing the potential risk for inhalation by dental staff, patients and the subsequent deposition on surfaces. The pathogens carried within these aerosols can contribute to the transmission of infectious diseases, including respiratory infections, which are a major concern in dental settings.

Other sources of contamination are as a result of ultrasonic scalers and water syringes that can result in varying amounts of aerosols produced and dispersed into the environment.[11,12,14] Ultrasonic instrumentation contribute to the production of aerosols by means of the high-frequency vibrations on dental plaque or calculus buildup.[11] The airway syringe used for irrigating and drying during dental procedures is another contributor to the production of aerosols, where the compressed air interacts with water or saliva which results in the spread of microorganisms present in the oral cavity.[12] An additional source of contamination is the dental unit water line (DUWL). DUWL can carry low levels of microbial pathogens that can develop biofilms and can become a source of contamination during dental procedures.[15]

The production and composition of bioaerosols in dental settings is influenced by various factors that are associated with the dental procedure being performed and the patient.[12,13] The patient factor in the composition of bioaerosols is influenced by saliva, intra-oral infections, biological matter, blood, and infective agents from the respiratory system.[11] Patients with compromised immune systems or those who are actively infected have an increased chance of spreading pathogens by coughing, talking and sneezing.[16] Saliva and blood from patients contain a wide range of microorganisms, including viruses, bacteria and prions.[11,16] Recent public health challenges, such as the Coronavirus Disease 2019 (Covid-19) pandemic and the emergence of mpox, have underscored the importance of understanding and mitigating the risks associated with bioaerosols.

Rafiee et al, 2022 suggested that contrary to other reports, patients' nasal and salivary fluids are not the primary sources of bioaerosols in dentistry and, while it does contribute to the overall microbial load in the dental settings, their contribution is comparatively insignificant when compared to AGP using ultrasonic scalers or high-speed drills.[12,14,17] This claim is, however, not supported by the available studies that support the theory that saliva contamination results in exposure to pathogenic microorganisms. In the case of Covid-19, it can spread through respiratory droplets and saliva.[11] This is usually directly from a symptomatic or asymptomatic patient or indirectly from contaminated surfaces. The virus can also spread through aerosols generated during certain dental procedures, posing a significant risk in the dental setting.[8,12,18,19] It is important to note that saliva contains a wide range of microorganisms and can increase the risk of transmission by contamination through either aerosolised form, direct contact or a secondary surface contamination.[20]

Aerosolised saliva can contaminate surfaces, instruments and personal protective equipment (PPE), leading to the potential spread of infections within dental clinics. The risk of contamination is particularly high in enclosed spaces where ventilation may be limited.[17,21] Variables such as ventilation through open windows, doors or air conditioning can affect the distribution and spread of bioaerosols, leading to variations in contamination.[11,16,17]

The possible routes for infection transfer in a dental clinic as described by the World Health Organisation (2020) are: direct droplet spread, indirect contact spread and airborne spread.[22] Direct droplet spread occurs when respiratory droplets or aerosols of an infected individual come into contact with mucous

Table I: This table categorises various microorganisms commonly found in the dental clinic, detailing key characteristics and potential health risks.

Category	Microorganism	Characteristics
Viruses	Hepatitis B Virus (HBV)	Causes hepatitis; spread through blood and bodily fluids
	Hepatitis C Virus (HCV)	Similar to HBV; leads to chronic liver disease
	Human Immunodeficiency Virus (HIV)	Attacks the immune system
	Herpes Simplex Virus (HSV)	Causes cold sores
	Human Papillomavirus (HPV)	Associated with warts and certain cancers
	Varicella Zoster Virus (VZV)	Causes chickenpox and shingles
	Influenza A (H1N1)	Can result in respiratory illness, including pneumonia or respiratory failure
Bacteria	Staphylococcus aureus	Known for skin infections; resistant strains (MRSA) exist
	Streptococcus mutans	Linked to dental caries and plaque formation
	Streptococcus pyogenes	Causes throat infections and other complications
	Pseudomonas aeruginosa	Opportunistic pathogen; resistant to many antibiotics
	Legionella pneumophila	Causes Legionnaires' disease; found in water sources
	Mycobacterium	Causes respiratory infections; linked to DUWLs
Fungi	Candida albicans	Common in oral cavity; can cause thrush
	Aspergillus spp.	Associated with respiratory issues and allergies
	Penicillium spp.	Can cause respiratory issues and allergies
	Cladosporium spp.	Common allergen; associated with asthma
	Alternaria spp.	Another common allergen; found in damp environments

8,12,15,26-34

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membranes of a new host.[12,21] Indirect contact spread is caused by cross-contamination or incorrect hand hygiene and transfer from contaminated surfaces or instrumentation.[11] Airborne spread refers to the transmission of pathogens through aerosols inhaled by patients or dental staff.[20,21,23]

Identifying the specific pathogens associated with bioaerosol contamination allows dental professionals to assess the risk to patients and staff. Certain pathogens are classified more hazardous or transmissible than others and require specific disinfectants.[24] In addition, some pathogens are able to survive on certain substrates and measures can be taken to isolate and eliminate the source, reducing the risk of wider contamination.[25]

Pathogen survival and transmission risks in dental settings

Among the viral pathogens, the most significant and common are those that can be transmitted through blood and bodily fluids, such as Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), Hepatitis B Virus (HBV), Hepatitis C Virus (HCV) and Human Immunodeficiency Virus (HIV). Human Papillomavirus (HPV) and Varicella Zoster Virus (VZV) are also potential contaminants, with the transmission occurring during contact with infected bodily fluids or aerosolised particles.[12,28,34,35]

Bacterial contamination in dental environments is equally concerning and include Staphylococcus aureus, including methicillin-resistant strains (MRSA), which is a common pathogen, often associated with skin infections. Streptococcus mutans, commonly found in the oral cavity, are linked to dental caries.[29] Opportunistic pathogens such as Pseudomonas aeruginosa and Legionella pneumophilia are commonly found in dental water lines, potentially leading to respiratory issues.[36] Oral microorganisms such as Micrococcus spp. and Corynebacterium spp. are also found in aerosols, indicating the presence of bacteria originating from the oral cavity.[30] A common bacterium *E. faecalis* is a resilient pathogen, particularly in dental environments. It is frequently associated with root canal infections and is known for its resistance to treatment and poses a significant risk for contamination due to its ability to survive harsh conditions.

Fungal pathogens such as *C. albicans,* aspergillus spp., Penicillium spp., Cladosporium spp. and Alternaria spp. have been reported to have contaminated dental settings. These fungi are often associated with immunocompromised patients.[37] The ability of these microorganisms to remain on flat and non-flat surfaces, as well as their presence in aerosols, increases the risk of spread of potentially harmful pathogens including antibiotic resistant strains such as MRSA.[32]
Studies have provided evidence that different pathogens can survive on environmental surfaces and pose a health risk – for example, the influenza virus can survive on surfaces for up to 48 hours, while *Mycobacterium tuberculosis* bacteria can survive on surfaces for up to four months.[12] Holiday et al 2020 reported that SARS- CoV-2 may remain viable and infectious in aerosols for several hours and on surfaces for several days.[21,26,30] In the study by Van Doremalen et al. (2020); SARS-CoV-2 and SARS-CoV-1 can remain viable on environmental surfaces consisting of: plastic, wood, copper, stainless steel, cardboard, cloth and the outer layer of surgical masks.[38] The study concluded that the SARS-CoV-2 virus was more stable on plastic and stainless steel (up to 72 hours) than in copper (up to 4 hours) and cardboard (up to 24 hours). In addition, SARS-CoV-2 virus remained viable in aerosols throughout the duration of the experiment (3 hours).[38] The H1N1 influenza virus can survive on surfaces in a dental clinic for a few hours to up to two days, depending on environmental conditions such as temperature and humidity. The virus tends to survive longer on non-porous surfaces such as stainless steel or plastic than on porous materials such as fabric. Mpox virus can survive on surfaces for several days to weeks, particularly in cool, dry environments, and on porous materials such as bedding and clothing, making thorough disinfection crucial to prevent transmission.

Atmospheric conditions such as temperature and relative humidity can influence the endurance of aerosolised viruses with low humidity levels prolonging viral survival.[12,24,28,34] A primary consideration when selecting a disinfectant that is effective against any microorganism is its ability to penetrate.[39] Several of the aforementioned pathogens have the ability to form biofilms. Biofilms are protective matrixes that inhibit the penetration of a disinfectant and can often result in an increased risk of contamination and resistance development.[32,35] The presence of antibiotic-resistant pathogens poses a significant concern, with the potential for nosocomial infections, and highlights the need for improved infection prevention and control measures.[40]. Murakami and Fujii (2018) confirmed the likelihood of drug-resistant bacteria MRSA colonising the oral cavity and by default be associated with surface contamination in dental clinics because of the nature of the profession.[40,41] Additionally, understanding the survival times of these pathogens on various surfaces and within aerosols helps inform infection control strategies, leading to safer dental spaces.

While the virulence of pathogens enhances their ability to infect susceptible hosts, another factor is the routes in which infections can be transmitted. The most obvious source of these pathogens associated with contamination is saliva from the patient's oral cavity.[24] In addition to the study of commensal pathogens associated with the oral cavity the Covid-19 pandemic resulted in a burst of investigations notably in relation to how infections are transferred from one host to another.[37,42-44]

Saliva-related risks in dental practice amid Covid-19

Management of saliva contamination during the Covid-19 pandemic was of utmost importance especially in light of the ability of the virus to spread via saliva.[18,45] The article by Chopoorian et al (2023) outlines the pathways for Covid-19 to be present in saliva.[45] Direct exchange of secretions from the upper and lower respiratory tract and the oral cavity, the presence of the virus was noted in gingival crevicular fluid, which is rich in blood components and can contribute viruses to saliva.[46]

The salivary glands are a potential source of the virus, as epithelial cells of salivary gland ducts are early targets for Covid-19 infections.[19,46] Lastly, the posterior oropharyngeal saliva samples from Covid-19 positive patients can remain serially positive for viral load for up to 25 days from the onset of symptoms. This prolonged viral shedding in saliva highlights the potential for transmission of Covid-19 even in individuals who may not exhibit symptoms.[46] Gaudin et al (2020) and Patel (2020) reported that saliva contamination is a significant source of SARS CoV-2 transmission due to its presence in aerosols created during dental procedures and SARS-CoV-2 was detected in saliva samples from 87%-100% of clinical

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patients.[19,54,46] These studies on how Covid-19 is transferred and its presence in aerosols refutes the report by Rafiee et al (2022) that stated salivary and nasopharyngeal secretions are negatable. This information is of critical importance in understanding and managing saliva contamination in dental clinics and to mitigate the risk of Covid-19 transmission via aerosol contamination.[47]

As previously described bioaerosols can contain a multitude of microorganisms that can contaminate various surfaces in dental clinics, including countertops, dental chairs and handpieces with biofilm producing bacteria, which increases the risk of cross contamination.[31,48,40] This is supported by the study by Liu et al (2023) that reported biofilms can adhere to living or abiotic (non-living) surfaces, which might include surfaces in the medical environment.[50] Biofilms formed from saliva-contaminated surfaces may harbour pathogenic bacteria, fungi or viruses increasing the risk of infection transmission between patients and dental healthcare workers.[50]

Mpox: A critical concern for healthcare professionals in dental settings

Amid recent developments, mpox has become a critical concern for healthcare professionals due to its transmission from animals to humans. Human monkeypox, now referred to as mpox, was first identified in 1970 in the Democratic Republic of Congo[1,53]. Mpox is a viral zoonotic disease related to smallpox transmitted from animals to humans through a bite or a scratch from infected animals. While endemic to Africa, multiple cases outside of disease endemic countries shows that it has become a significant travel-related disease and all health care workers including dental personnel should be cautious in preventing its spread.[53,54] Human-to-human transmission of mpox is rare but can occur through direct contact with lesion material or respiratory droplets. The main entry sites for mpox are inhalation, open wounds, non-intact skin and mucous membranes.[53,54,55]

The infection spreads through large respiratory droplets and requires prolonged close contact, unlike SARS-CoV-2 infection, which can spread via small droplets. Experimental studies suggest mpox virus can remain infective in aerosols for several hours and may spread via aerosolised particles. The mpox virus primarily infects the following areas of the body:

1. Skin and mucous membranes: Mpox virus often causes skin lesions that begin as macules and vesicles and eventually form scabs. It can also affect mucous membranes, including the oral mucosa, where it presents as macules and vesicles.
2. Lymphatic system: The virus can cause significant swelling in lymph nodes near the site of infection.
3. Respiratory tract: While less common, mpox virus can infect the respiratory tract, as the virus is spread through respiratory droplets. However, the primary mode of transmission is through direct contact with skin lesions or bodily fluids rather than airborne particles.[53,54,55,56]

Initial symptoms often appear in the oral cavity with macular lesions, followed by a characteristic rash. The highly contagious incubation period commonly ranges from 7 to 14 days. The prodromal symptoms last from 2 to 4 days, which is characterised by fever and lymphadenopathy, followed by cutaneous involvement. This is characterised by single to multiple lesions that change from maculae to papules in 12 days. In addition, vesicles and pustules present at various stages.[53,54,55,56]

Oral lesions occur in 70% of cases, presenting as perioral mucocutaneous lesions and vesicles on the oral mucosa and lips which may precede the skin rash. Mpox is a self-limiting disease with very low mortality and may last from 2 to 4 weeks. Although mpox is similar to chickenpox, there are a number of differentiating signs, the main element being lymphadenopathy. Mpox positive individuals are considered contagious during the prodromal or acute phase and even though mpox appears to be a significant travel-related disease in light of recent developments dental healthcare workers should note that initial signs of the disease usually appear on the oral mucosa prior to the characteristic skin lesions.[53,54,55,56]

Based on this characteristic, dental health care providers need to be cognisant of the clinical presentation of the disease but also of the associated preventive measures for infection control in dental settings. Oral screening is recommended in high-risk individuals and in patients with an unexplained rash and one or more symptoms typical of monkeypox.

A differential diagnosis for monkeypox includes varicella-zoster virus infections such as chickenpox and herpes zoster (shingles), though chickenpox lesions are typically not umbilicated, and herpes zoster has a dermatomal distribution. Molluscum contagiosum, another Poxviridae virus, can cause similar raised, pink lesions with central dimples. In cases where oral ulceration is an early symptom, other causes such as traumatic ulceration should be considered, but the presence of systemic symptoms such as fever and lymphadenopathy suggest an infectious cause.[53,54,55,56]

Given the mpox transmission routes, all healthcare workers are at increased risk of infection from close and prolonged contact with patients. Oral healthcare providers may be at additional risk because they have close contact with patients for prolonged periods, and dental procedures may generate infected droplets and aerosols. Infected fluids from perioral or oral lesions containing mpox virus or from saliva and blood can enter the environment through direct contact and droplets. In addition, mpox virus remains infectious in aerosols for several hours. Aerosolisation can be considered an important route of transmission in dental settings, further increasing the risk of occupational exposure for dental personnel and cross-infections in dental settings. As previously mentioned, dentists should be vigilant when examining suspected mpox cases, as primary lesions often start in the oropharynx and oral samples, including saliva, may have the highest viral load, with viral shedding detectable in oropharyngeal secretions before skin lesions develop. Viable mpox virus can be found in oral samples from days 9 to 18. Basic principles of infection control are currently considered able to contain mpox spread.[1,53,54,55,56]

This includes the rapid diagnosis isolation, contact tracing and surveillance during the viral incubation period. In dental clinics, precautions against mpox involve distinguishing it from similar lesions and taking comprehensive infection control measures. The main transmission route involves contact with the lesion, so it is crucial to implement that series of precautions to control standard and contact infections when treating patients with symptoms of mpox.[53,54] Clinicians

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should use standard, contact and droplet precautions, including N95 masks, FFP3 respirators, fluid-resistant attire, and eye protection, especially in isolated treatment areas. Proper hand hygiene, cleaning and disinfecting, and careful handling of materials are essential. In the case of a suspected monkeypox infected patient, the patient should be provided with a surgical mask and asked to return home to isolate and await further advice.[53,55,56] The dental healthcare professional should then contact their local health protection team for guidance.

It is important to note that pre-procedural mouth rinses can mitigate some risks associated with saliva contamination; however, it serves a method to reduce rather than eliminate pathogenic load.[35,51] While both mpox virus and SARS-CoV-2 pose significant risks, their differences in transmission dynamics and clinical management necessitate varied approaches to infection prevention. For instance, while the risk of aerosol transmission in SARS-CoV-2 has led to the widespread adoption of enhanced personal protective equipment (PPE) and air filtration systems, mpox requires additional considerations, such as the handling of contaminated materials and the potential for skin-to-skin contact transmission.[53,54,55] The knowledge and understanding of how infectious agents are transferred for one host to another, biofilm formation and its implications in the dental surgery is an important prerequisite for dental staff. This understanding is central in implementing successful infection control and prevention strategies aimed at combating biofilm formation on dental instruments and environmental surfaces, which encompasses the management of saliva contamination.[46,52]

In conclusion the risk of pathogen transmission in dental clinics encompasses both established and emerging threats. Traditional pathogens such as bacteria, viruses and fungi continue to pose significant risks; however, emerging threats such as monkeypox, with distinct transmission routes and clinical implications, highlight the need for an adaptable approach to infection control. The ongoing evolution of infectious disease threats underscores the necessity for continuous vigilance and the regular updating of infection control protocols. Dental practices must remain proactive in integrating new evidence and guidelines to safeguard both patients and healthcare providers. By staying informed and responsive to emerging threats, dental clinics can better protect their patients and staff from infection and ensure a safer clinical environment.

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Perspectives on the Minamata Convention and dental amalgam waste management in South Africa

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SM Sudi[1], S Naidoo[2]

ABSTRACT

The Minamata Convention on Mercury (MCM), a pivotal multilateral agreement, is dedicated to controlling human sources of mercury environmental release. Due to their unique properties, mercury and its compounds were extensively used in products and industrial processes. Human activities have escalated atmospheric mercury levels by 450%, causing severe environmental and life-threatening consequences. The MCM focuses on restricting mercury mining, phasing out and phasing down mercury use in products and processes, controlling environmental emissions and regulating small-scale gold mining. Dental amalgam restorative material is the only product subject to a phase-down approach through the prevention of dental caries, research for alternative restorative materials, and waste management practices. The increasing understanding of mercury's health and environmental impacts has led to restricting dental amalgam use in pregnant women and children, phase-out in several countries, and cessation of the marketing of dental amalgam by some manufacturers. This perspective delves into the current approaches to managing dental amalgam waste and proposes improvements to dental amalgam waste management practices in South Africa.

Keywords

Minamata Convention, mercury, dental amalgam, dental amalgam waste

Introduction

The 2013 Minamata Convention on Mercury (MCM), the 2001 Stockholm Convention on Persistent Organic Pollutants, the 1998 Rotterdam Convention on Prior Informed Consent Procedure for certain Hazardous Chemicals and Pesticides in International Trade and the 1989 Basel Convention on the Control are all global multilateral and legally binding environmental agreements that aim to protect human health and the environment from hazardous chemicals and waste.[1] The MCM came into force on August 16 2017 and sought to control the anthropogenic release of mercury throughout its life cycle.[2] The MCM focuses on banning new mercury mines, phasing out existing mines, phasing out and phasing down mercury use in products and processes, controlling environmental emissions, and regulating the informal sector of artisanal and small-scale gold mining.[3] The MCM is of interest to oral health practitioners because of the potential environmental release of mercury waste from dental amalgam restorative material. The dental amalgam restorative material comprises 43-50% liquid mercury, which forms an intermetallic alloy with varying amounts of silver, tin, copper, zinc and palladium.[4] In the MCM, dental amalgam is subject to a phase-down approach based on prevention, research for alternative materials, and waste management practices. The debate on the use of dental amalgam in South Africa has been reignited by the recent publication of the Department of Forestry, Fisheries and the Environment's amended draft national regulations for the management of mercury in South Africa to stakeholders.[5] 2024 is the fifth year since South Africa acceded as a party to the MCM.[6]

Authors' information
1. Stephen M Sudi, *DDS*, *MSc*, Faculty of Dentistry, University of Western Cape, Cape Town, South Africa
ORCID: 0009-0003-2223-7244
2. Sudeshni Naidoo, *BDS*, *LDS.RCS*, *MDPH*, *DDPH.RCS*, *MChD*, *PhD*, *Dip IRE*, *DSc*, Faculty of Dentistry, University of the Western Cape, Cape Town, South Africa
ORCID: 0000-0001-7424-8082

Corresponding author
Name: Stephen M Sudi
Email: ssudi@uwc.ac.za

Author's contribution
1. Stephen M Sudi: conceptualisation, draft preparation (60%)
2. Sudeshni Naidoo: draft preparation, review and editing (40%)

Brief background of mercury in the environment

Mercury is a naturally occurring element, the only liquid metal at room temperature. It exists in multiple oxidative states, inorganic salts and organic complexes,[7] all of which present with varied chemical affinities, biological activity and toxicity.[8] Mercury's chemical and physical properties have led to its widespread use in various products and manufacturing processes, leading to detrimental environmental release and human exposure.[9] Other sources of environmental mercury release are geologic processes such as volcanic activities.[10] Human activities have increased total atmospheric mercury concentration by about 450% above natural levels.[9] In a 2010 report by Masekoameng et al South Africa was ranked as the sixth largest emitter of mercury, releasing 29.47t, with 80% of the emissions originating from coal-fired power generation.[11]

Mercury is a recognised global pollutant that persists in the environment, bioaccumulates and biomagnifies in the food chain and has adverse health effects on human health, animal life and the environment.[3] Human exposure occurs mainly through the ingestion of fish and other marine species contaminated with organic mercury or through contact with mercury used in products and processes, such as artisanal and small-scale gold mining.[12] The World Health Organization (WHO) has described mercury as one of the 10 chemicals of public health concern.[13]

The most significant and catastrophic mercury poisoning occurred in Minamata, Japan. In 1932, the Chisso factory started producing acetaldehyde using inorganic mercury as a catalyst and released effluent into the Minamata Bay and the Shiranui Sea. Minamata Bay residents reported dwindling fish catches, deranged flight in crows, and cats exhibiting

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strange movements, convulsions and deaths.[14] In April 1956, two sisters, aged five and two, presented with unexplained neurological symptoms at Chisso Hospital and, by August 1956, 30 cases and 11 deaths were attributed to "Minamata Disease".[15]

Methylmercury, a by-product in synthesising acetaldehyde, was recognised as the cause of neurological symptoms in October 1959.[16] The released methylmercury bioaccumulated in marine life, a staple diet of the Minamata population, leading to acute and chronic methylmercury poisoning.[17] More than 2,000 individuals were officially recognised as Minamata Disease patients, with several tens of thousands exhibiting neurological symptoms characteristic of methylmercury poisoning.[18] The Minamata convention is named after the Minamata Bay disaster, a remembrance of the lives lost and a commitment to addressing the anthropogenic release of mercury.

It is well known that the consumption of marine life contaminated with methylmercury is associated with long-term neurocognitive deficits in exposed children and increased cardiovascular risks in adults.[19] The health risks of consuming marine life contaminated with methylmercury are similarly pertinent to South Africa. In 2015, mercury levels higher than the recommended levels by the WHO in some fish samples from Cape Town and Durban were reported, leading to the release of a dietary advisory for allowable fish consumption in South Africa.[20]

South Africa has witnessed the ravages of mercury poisoning and environmental contamination through industrial exposure and artisanal and small-scale gold mining (ASGM). Occupational exposure of 30 workers (two of them fatally) at a mercury processing plant owned by Thor Chemicals and environmental contamination of the Mngceweni River in KwaZulu-Natal were reported in the 1990s.[21] In a study conducted in 1999, fish collected from the local water streams downstream of the Thor plant exhibited elevated mercury levels.[22] Ten years later, Papu-Zamxaka et al described elevated mercury levels in fish and soil samples from the uMgeni River and in hair samples from individuals who consumed fish from the uMgeni River and the Inanda Dam.[23]

The Thor Chemicals saga further offers a glimpse at the challenges of long-term storage of mercury waste in a developing country. Mercury waste originating from the Thor Chemicals site has been subject to fires at a processing plant and the A-Thermal processing plant in Gauteng and pilfering at the plant site in Cato Manor, potentially leading to further environmental releases and contamination.[24]

Artisanal and small-scale gold miners' informal and unregulated mining is prevalent in disused and functioning gold mines in South Africa and the Southern African region.[25] Artisanal and small-scale gold mining (ASGM) utilises elemental mercury to extract gold from ore. The mercury vapour released can potentially cause neurological, cognitive and several other health problems for miners and communities.[26,27] ASGM is currently the largest source of mercury pollution in the world, contributing 38%, or 838 tonnes, of mercury released into the environment. In Sub-Saharan Africa, emissions from ASGM account for 70%-85%.[9] South Africa is a major mercury trade hub in Sub-Saharan Africa. A regional report on the mercury trade and use for ASGM in Sub-Saharan Africa indicated that mercury destined for ASGM activities might be imported as dental amalgam and liquid mercury imported for dental use is used for ASGM.[28] As more controls are introduced in the mercury trade, it is essential to apply standards and custom codes that ensure dental amalgam is unavailable in mercury and alloy bulk forms that facilitate diversion to ASGM in the region.

Dental amalgam in the Minamata Convention

In the MCM, dental amalgam is the only mercury-added product subject to a phase-down approach based on prevention, research for alternative materials and waste management practices.[3] Annex A Part II of the Convention addresses provisions aimed at a phase-down of dental amalgam, of which a party shall implement two or more of the nine measures (Table I). In 2022, the fourth conference of parties of the MCM added three more provisions on restricting the use of bulk dental amalgam, restricting the use of dental amalgam in children under 15 years of age, pregnant and breastfeeding mothers, and on reporting mechanisms for national action plans for countries that are yet to phase out dental amalgam.[29]

Table I. Dental amalgam phase-down measures

Dental amalgam
Measures to be taken by a party to phase down the use of dental amalgam shall consider the party's domestic circumstances and relevant international guidance and shall include two or more of the measures from the following list:
(i) Setting national objectives aiming at dental caries prevention and health promotion, thereby minimising the need for dental restoration. (ii) Setting national objectives aiming at minimising its use. (iii) Promoting the use of cost-effective and clinically effective mercury-free alternatives for dental restoration. (iv) Promoting research and development of quality mercury-free materials for dental restoration. (v) Encouraging representative professional organisations and dental schools to educate and train dental professionals and students on the use of mercury-free dental restoration alternatives and on promoting best management practices. (vi) Discouraging insurance policies and programmes that favour dental amalgam use over mercury-free dental restoration. (vii) Encouraging insurance policies and programmes that favour the use of quality alternatives to dental amalgam for dental restoration. (viii) Restricting the use of dental amalgam to its encapsulated form. (ix) Promoting the use of best environmental practices in dental facilities to reduce releases of mercury and mercury compounds to water and land.
In addition, parties shall: (i) Exclude or not allow, by taking measures as appropriate, the use of mercury in bulk form by dental practitioners. (ii) Exclude or not allow, by taking measures as appropriate, or recommend against the use of dental amalgam for the dental treatment of deciduous teeth, of patients under 15 years and of pregnant and breastfeeding women, except when considered necessary by the dental practitioner based on the needs of the patient. Parties that have not yet phased out dental amalgam shall: (iii) Submit to the secretariat a national action plan or a report based on available information with respect to progress they have made or are making to phase down or phase out dental amalgam every four years as part of national reporting.

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Additionally, the MCM mandates that mercury waste be managed in an environmentally sound manner by considering the guidelines developed under the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. The environmentally sound management of mercury framework guides handling, interim storage, transportation, treatment, recovery, stabilisation, solidification and long-term storage. The United Nations Environment Programme (UNEP) developed a practical sourcebook,[30] updated the guidelines[31] and produced a catalogue of technologies and services for mercury waste management[32] to facilitate the environmentally sound management of mercury waste. Oral health practitioners need to be aware of the current management protocols for mercury waste, as they are likely to affect the cost of dental amalgam and waste management services.

Dental amalgam use and waste management in South Africa

The global mercury consumption in dental applications in 2015 was estimated at an average of 274 tonnes, with sub-Saharan Africa consuming between 5 and 9 tonnes of mercury.[9] Dental amalgam is an essential restorative material in primary oral health care provision in South Africa.[33] The estimates of dental amalgam usage in South Africa obtained by use from the 2011 inventory of mercury releases suggest that 70-100kg of dental amalgam was sold annually between 2009 and 2011, with a further 50kg of non-amalgamated mercury sold to dental practitioners.[34]

The use of dental amalgam produces waste, which poses a risk of mercury contamination in the environment,[35] through direct wastewater discharge, incineration of healthcare waste, landfilling, sewage sludge incineration, cremation and burials.[36] Dental amalgam waste is categorised as non-contact and contact amalgam waste. Used capsules and amalgam scraps form non-contact amalgam waste, while contact amalgam waste is composed of carved amalgam, amalgam captured in chairside traps, vacuum pump filters and extracted teeth.[36] Drummond et al estimated that without proper waste management, about 50% of dental amalgam used in restorations could end up in the waste stream.[37] Dental amalgam particles settle in wastewater lines, leading to continuous leaching of mercury, exacerbated by the use of oxidising wastewater cleaning agents.[38] The production of organic methyl mercury in dental wastewater lines by sulphate-reducing bacteria has been previously reported.[39]

Managing dental amalgam waste in developing countries is challenging, and containment systems are neither affordable nor readily available. In the East Arica Dental Amalgam Phase-down Project (EADAP), the high cost of mercury waste containment systems and lack of processing facilities were described as significant challenges.[40] The informal global WHO consultation with policymakers in dental public health on implementing the Minamata Convention on Mercury reported that only nine percent of countries in the African region have phased out the use of dental amalgam, 30% have no plan to phase out dental amalgam and only 17%-23% of the countries still using dental amalgam have regulations on dental amalgam waste and disposal.[41] The risks of environmental contamination with mercury from dental amalgam and the increasing knowledge of the dangers posed by mercury releases have created new dynamics and considerations for dental amalgam use in developing countries.

In South Africa, the regulatory framework for healthcare risk waste is provided by a set of acts, regulations, norms and standards, mainly from the Department of Environmental Affairs through the National Environmental Management: Waste Act (Act 59 of 2008), the National Department of Health, National Health Act (Act No. 61 of 2003) and various provincial legislation and regulations.[42] Healthcare waste in South Africa is categorised into two main groups: healthcare risk waste (HCRW), which is infectious or hazardous, and healthcare general waste (HCGW), similar to domestic waste.[43] An estimated 48,749 tonnes of healthcare risk waste were generated in South Africa in 2017, with waste management services provided by 15 operational HCRW facilities.[44] The South African Bureau of Standards developed the available guidelines for managing healthcare waste in South Africa. The South African National Standard SANS 10248-3 provides guidelines on managing healthcare risk waste from minor generators, with oral healthcare centres listed among the intended. The guideline adequately outlines requirements for oral health care professionals in the general responsibilities documentation, contractual commitments with waste management firms, training, workplace hygiene and health and safety, guidelines in identification, classification, segregation, collection and packaging of health care waste, characteristics of storage areas, and modalities of transportation, treatment and disposal of healthcare waste.[45] The guideline falls short of the current dental amalgam waste management standards known as the Best Management Practices for Dental Amalgam Waste (BMPs).[46] The American Dental Association developed the BMPs and introduced an accompanying guide for incorporating BMPs into dental practice.[47] The BMPs and accompanying guide for incorporating BMPs into dental practices were later adopted by the World Health Organization.[48] Developing a new healthcare waste guideline for oral health services in line with internationally recognised standards will facilitate the proper management of amalgam waste and meet a measure stipulated in the Minamata Convention. Furthermore, local development and manufacture of technologies such as containment systems and separators will facilitate adaptation of the new guidelines and provide for the growth of circular economy opportunities in the country and the region.

The Department of Environmental Affairs (DEA) promoted appropriate traps in dental wastewater to prevent potential mercury contamination from using dental amalgam[49] and, furthermore, the South African Dental Association (SADA) advocated the introduction of BMPs for dental amalgam use to prevent environmental mercury contamination.[50] Recently, the Department of Forestry, Fisheries and the Environment released the amended draft of national regulations for the management of mercury in South Africa to stakeholders. In the draft regulations, dental amalgam phase-down approaches include limiting the use in pre-dosed encapsulated form, ensuring the installation of amalgam separators in dental facilities from 1 April 2025, curbing the release of dental amalgam into the environment and providing guidelines for phase-down plans. The contravention of regulations related to dental amalgam is an offence liable to a fine and/or imprisonment.[5]

The standard for dental amalgam used in South Africa is an identical implementation of the international standard ISO 24234:2004. In the standard, the amalgam alloy can be packaged as powder in bulk or tablets, with the mercury supplied in bulk or sachets, or both mercury and alloy

supplied in a pre-dosed capsule.[51] In response to measures stipulated in the Minamata Convention, a new dental amalgam standard, ISO 20749:2023, was developed to enable countries that do not allow the use of products other than pre-capsulated amalgam to use the ISO Standard.[52] Adapting this new standard will help enforce dental amalgam availability in South Africa in pre-capsulated form and enable the country to meet the requirements of the additional measures stipulated in the Minamata Convention.

SADA entered into a collaboration with Dental Recycling International, which facilitated the availability of amalgam separators in South Africa.[53] This commendable initiative should be coupled with introducing BMPs, containment systems for noncontact amalgam waste, amalgam waste treatment and disposal vendors, and infrastructure to support the disposal and long-term storage of mercury waste.

CONCLUSION

The Southern African region faces challenges in providing oral health services due to limited financial and human resources, limited access and affordability, poverty and a higher burden of diseases.[54] The provision of restorative treatment has been problematic due to the lack of basic oral health care packages in the Western Cape, where less than 31.5% of dental clinics offer a basic treatment package.[55] Dental amalgam has long been known to be an affordable restorative material compared to other restorative materials.[56] However, the affordability of amalgam is historical: when amalgam was introduced, the alternative restorative material was gold, which was beyond the reach of many.[57] It is noteworthy to recognise that most studies that compare the affordability of dental amalgam do not consider the environmental, health and social management costs of continual usage of dental amalgam.[58] The increasing knowledge of the effect of mercury on health and the environment has led to the banning of amalgam use in pregnant women and children, advanced phase-out processes in several countries and the cessation of the marketing of dental amalgam by some manufacturers.[59]

South Africa, the continent's second-largest economy, is in the process of introducing a national health insurance scheme to promote quality, affordable and universal health coverage.[60] Dental amalgam is an essential restorative material in primary oral health care provision in South Africa[33] and the use of dental amalgam is still taught in South Africa's dental schools.[61] An in-depth analysis of the benefits of the continued use of dental amalgam is urgent, considering the complexities related to dental amalgam waste management, the impending phase-out in most developed countries that are a source of amalgam and the cost of waste management technologies.

Conflict of interest

The authors declare the manuscript was developed without commercial or financial relationships that could create a conflict of interest.

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Chronic granulomatous invasive fungal maxillary sinusitis: Report of the first case from South Africa

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A Odendaal[1], J Loock[2], A Afrogheh[3]

CASE REPORT

A 37-year-old South African woman was referred to an ear, nose and throat (ENT) specialist with a history of painful maxillary sinusitis with nasal obstruction. Five days prior to her presentation, she was admitted to a hospital emergency unit with clinical symptoms of headache, nausea, rigor, red eyes, body pain (back and chest pain) and photophobia. She was subsequently diagnosed with a viral infection, and was investigated to exclude the possibility of meningitis. Her blood test results revealed a shifting raised neutrophil count (9.6) and creatinine (79) but a CRP of less than 5, and further test results were normal. A computed tomography (CT) scan showed no evidence of focal brain lesions, cerebral oedema or hydrocephalus. However, there were radiological features of an enlarged left maxillary sinus ostium, which the radiologist reported as suggestive of previous sino-nasal surgery. There was also mucosal thickening of the maxillary sinuses. The mucosal lining was significantly thicker on the left side, where high density material was present. It was believed that the latter might indicate fungal sinusitis. The patient reported that she had no prior sinus surgery but had had two episodes of "sinusitis" with nasal obstruction and sneezing, that would leave a bad smell in her throat for two weeks. She also mentioned that the use of over-the-counter medication Sinutab had alleviated the sinusitis symptoms. At the time of her presentation, there was no nasal obstruction and no pain related to the sinuses. On examination anterior rhinoscopy and flexible fibre-optic endoscopy was completely normal bilaterally, with no signs of sinusitis and, in particular, no discharge from the left maxillary antrum. There was mild deviation of the nasal septum to the right. Review of the CT scan confirmed the expanded left maxillary sinus ostium and opacification of the enlarged left maxillary antrum, involving the lower two thirds of the sinus. It appeared that there were some "double densities" within the opacification with bulging of its superior margin, in keeping with a cystic lesion (Figure 1). The patient was therefore booked for endoscopic removal of the tissue in the left maxillary antrum. A standard left middle meatus antrostomy was done using the endoscopic approach, which showed a polyp with debris in the maxillary antrum. The debris was of the nature of caseous material. The polyp and the caseous material were removed, placed in a formalin container and submitted to the pathology laboratory for histological evaluation.

Microscopic examination of the tissue from the maxillary sinus revealed fragments of sinonasal mucosa with granulomatous inflammation (Figure 2a). The granulomas consisted of Langhans-type giant cells with central areas of necrosis (Figure 2b). The giant cells contained broad and acutely branching septated fungal hyphae with fruiting bodies, consistent with Aspergillus (Figure 2c). Periodic Acid Schiff (PAS) and Grocott Methanamine Silver (GMS) stains were done to best highlight the fungal organisms (Figures 2d-2f). Based on the clinical, radiologic and microscopic features, a diagnosis of chronic granulomatous invasive fungal sinusitis (CGIFS) was established.

On follow-up one week after the surgery the patient was well, and had no pain or discomfort in relation to the maxillary antra. In light of the absence of significant symptoms it was considered unnecessary to admit her for intravenous antifungal therapy, and treatment was initiated with oral voriconazole: a loading dose of 400mg twice a day for three days, followed by 200mg twice a day for one month, with follow-up at that time.

DISCUSSION

Fungal sinusitis is classified into two main groups – non-invasive and invasive. Each of these groups has three subgroups – see Table 1.

Table 1. Classification of fungal sinusitis

Non-invasive fungal sinusitis	Invasive fungal sinusitis
Allergic fungal sinusitis	Acute invasive fungal sinusitis
Fungal ball	Chronic invasive fungal sinusitis
Saprophytic fungal sinusitis	Chronic granulomatous fungal Sinusitis

Invasive fungal sinusitis can be acute or chronic.[1] Acute invasive fungal sinusitis (AIFS) is an aggressive rapidly invasive fungal sinusitis, often caused by hyphae form of the fungi *Zygomycetes* (such as *Rhizopus* and *Mucor*). AIFS has high mortality rates (50-80%) and is often seen in immunocompromised patients (commonly diabetics, HIV-positive patients and those with haematological malignancies).[2,3] The chronic form is further subdivided into non-granulomatous and granulomatous subtypes.[1] Chronic granulomatous invasive fungal sinusitis (CGIFS) is extremely rare and has a protracted clinical course, with progressive

Authors' information
1. Anneze Odendaal, *BChD*, Department of Oral Medicine and Periodontology, Faculty of Dentistry, University of the Western Cape, Cape Town, South Africa
2. James Loock, *MBChB*, *FCS* (SA) *ORL*, Emeritus Professor of Otorhinolaryngology, University of Stellenbosch, Division of Ear, Nose and Throat
3. Amir Afrogheh, *BChD*, *MSc*, *MChD*, *PhD*, Department of Oral and Maxillofacial Pathology, National Health Laboratory Service, Faculty of Dentistry, University of the Western Cape; Extraordinary Senior Lecturer, Division of Anatomical Pathology, Faculty of Medicine and Health Sciences, Stellenbosch University, Cape Town, South Africa

Corresponding author
Name: Amir Afrogheh
Email: amir.afrogheh@nhls.ac.za

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Granulomatous sinusitis, invasive fungal sinusitis, voriconazole, aspergillus flavus, chronic sinusitis, CT scan, maxillary sinus

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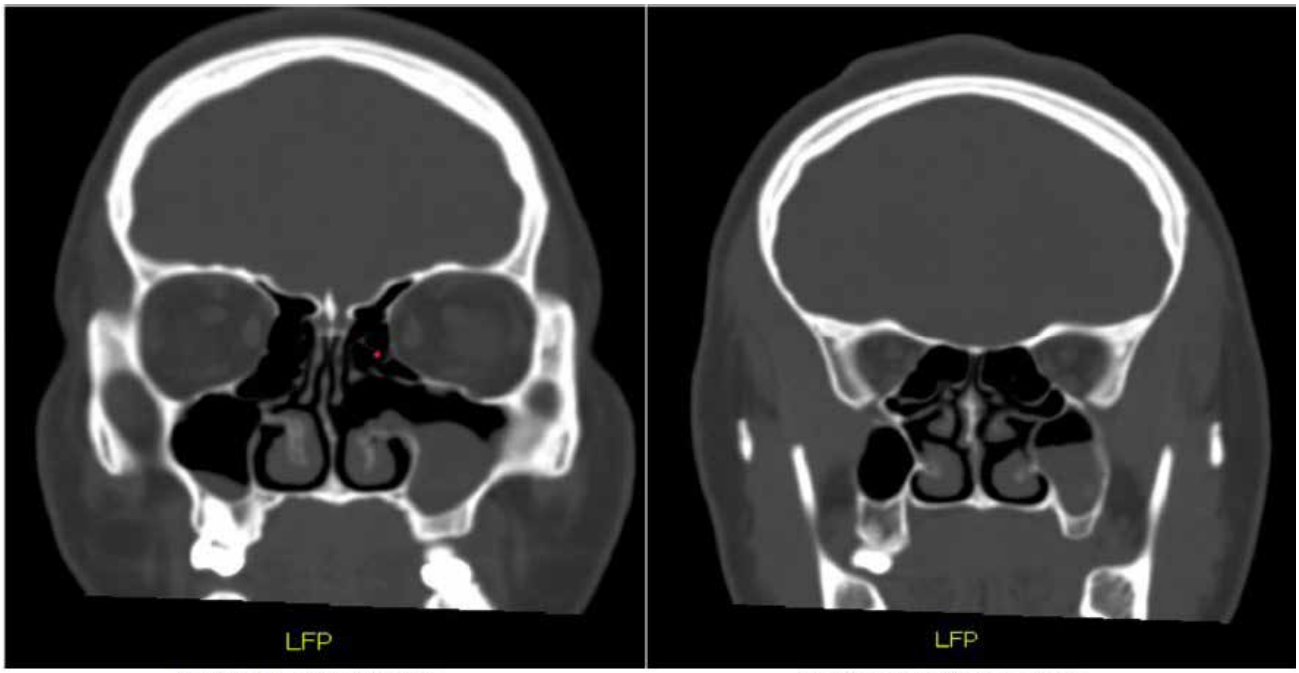

Figure 1. CT scan shows an expanded left maxillary sinus ostium and the presence of double densities in the left enlarged maxillary sinus.

invasion and destruction of the paranasal sinuses and the adjacent structures.[4-7] CGIFS primarily affects young to middle-aged immunocompetent adults with a slight female predominance.[8] The majority of CGIFS cases are diagnosed in patients from subtropical regions of India, Sudan, Pakistan and Saudi Arabia.[4-7] CGIFS is very rare in the western world with isolated cases reported from the US and the Balkan region.[4-7,9] To the best of our knowledge this is the first case report from the Western Cape region of South Africa. Aspergillus flavus is the main aetiologic agent; however, Aspergillus nidulans has been isolated from a few cases of CGIFS.[8] CGIFS predominantly occurs in maxillary and ethmoid sinuses, with the ethmoid sinus being the most common site of involvement.[10] In general, patients with CGIFS present with symptoms of chronic sinusitis (CS), namely nasal congestion, mucus discharge, postnasal drip, reduced sense of smell, facial pain/pressure and toothache.[9] In a study from Saudi Arabia, nasal obstruction was the most common presenting symptom in 87% of the cases.[10] Therefore, CGIFS is often misdiagnosed as CS, with consequent delay in treatment with significant morbidity. Although radiological imaging may suggest the possibility of CGIFS, with the characteristic feature being the so-called "double densities" (opacification of the sinusitis with denser and less dense areas), definitive confirmation of CGIFS requires histopathological evaluation and microbiological studies (eg culture).[1] Histological assessment of representative samples from CGIFS patients reveals granulomas with Langhans-type giant cells, surrounded by a rim of chronic inflammatory cells.[1] The giant cells contain broad and acutely branching septated Aspergillus hyphae with fruiting bodies.[1] The fungal hyphae are best highlighted on PAS and GMS special histological stains. The histological differential diagnosis of CGIFS includes other granulomatous inflammatory diseases of the sino-nasal region such as tuberculosis, leprosy, treponematosis, histoplasmosis, cryptococcosis, sarcoidosis and, finally, NK/T-cell lymphoma, which may have a vague granulomatous appearance.[11] Ziehl-Neelsen (ZN) and Fite special histological stains help to exclude mycobacterial infections, while Treponema immunohistochemistry (IHC), microbiological culture, chest imaging for hilar adenopathy and CD56 and EBERISH IHC help exclude treponematosis, histoplasmosis, cryptococcosis, sarcoidosis and NK/T-cell lymphoma respectively.[11] Due to the rarity of CGIFS, there is no standard treatment protocol. However, the Infectious Diseases Society of America recommends voriconazole as the drug of choice for the treatment of invasive Aspergillosis.[12] Indeed, some studies have found oral voriconazole, 200mg twice daily, with a mean duration of therapy of five to six months, effective in eradicating the disease.[8] Supplemental surgical debridement may help reduce the fungal load, allowing for shorter recovery time.[8] Death due to GCIFS is very rare and is usually seen in immunocompromised patients with sphenoid sinus involvement with intracranial extension.[8]

CONCLUSION

This is the first case report of CGIFS from the Western Cape region of South Africa. CGIFS represents an important diagnostic dilemma for the unwary ENT and oral health care professional due to its rarity and overlapping symptomatology to CS (eg nasal obstruction, toothache etc), with associated significant morbidity. A multidisciplinary approach is recommended for all non-resolving cases of CS, comprising haematological tests, radiological imaging, flexible endoscopy, histological examination and microbiological culture.

COMPLIANCE WITH ETHICAL STANDARDS

Funding

This is a case report and no funding was required.

Conflict of interest

All authors declare that they have no conflict of interest.

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with

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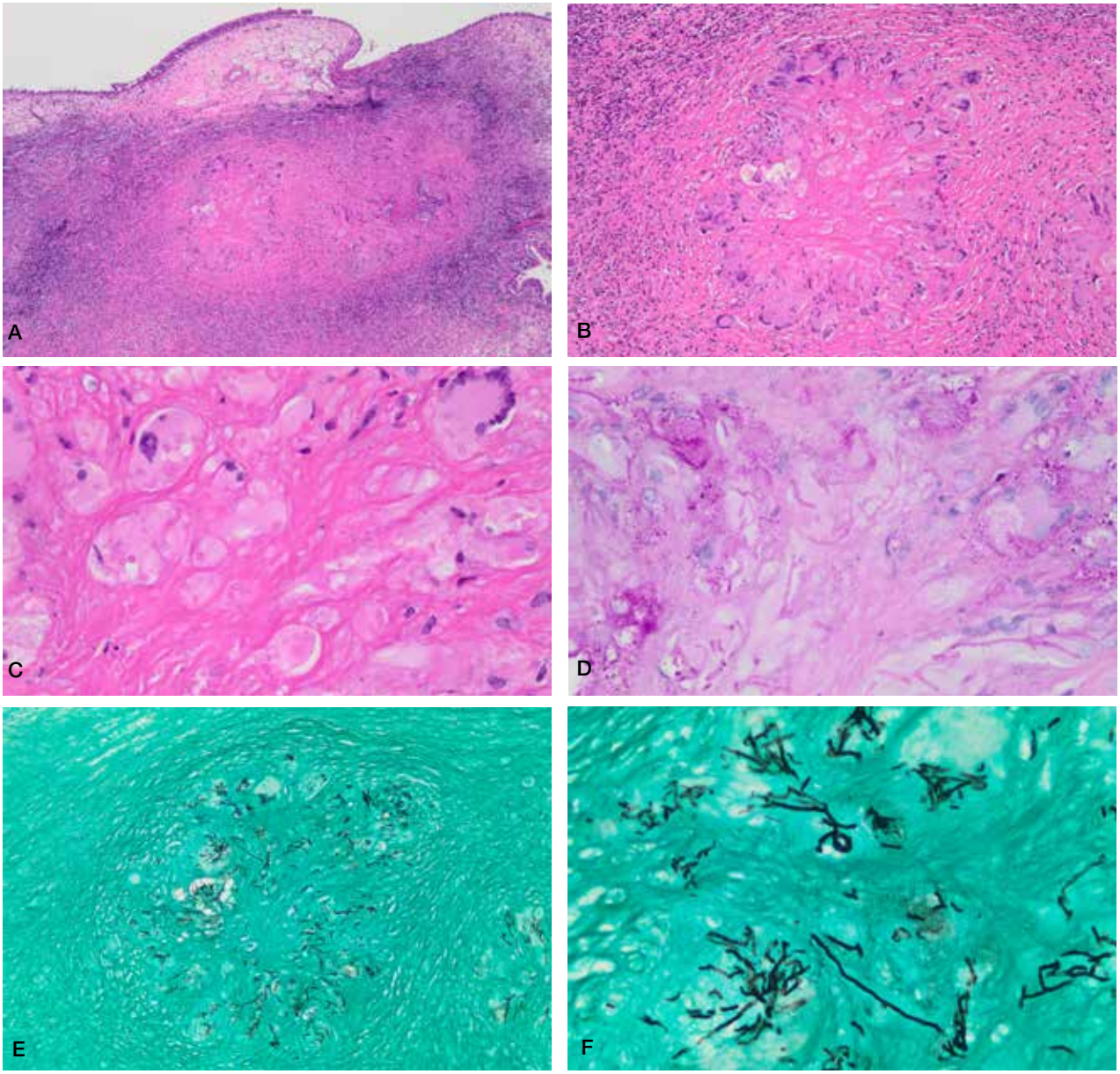

Figure 2(a). The photomicrograph shows a fragment of sinus mucosa surfaced by respiratory-type epithelium. The subepithelial connective tissue exhibits several necrotising granulomas (H&E, x10). **(b)** The image shows a granuloma consisting of multinucleated Langhans-type giant cells with a central area of necrosis (H&E, x20). **(c)** The giant cells contain hyphae with fruiting bodies (H&E, x40). **(d)** Acutely branching Aspergillus hyphae with fruiting bodies (PAS, x40). **(e,f)** The Grocott Methanamine Silver stain highlights the outline of a granuloma with black staining acutely branching Aspergillus hyphae with fruiting bodies (GMS, x40).

the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

INFORMED CONSENT

There are no patient identifiers in this case report and informed consent was obtained from the patient.

Consent for publication

For this type of study consent for publication is not required.

Availability of data and materials

All data sets and research materials are available for revision on request.

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Classification of cases of pre-eruptive intra-coronal resorption

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J Naicker[1], C Smit[2], A Uys[3]

ABSTRACT

Introduction

Resorption mechanisms triggered in teeth can lead to lesions, especially in impacted dentition. Evidence of these lesions can be detected via radiographic imaging and are often classified as pre-eruptive intra-coronal resorption (PIR). These external resorptive lesions do not typically present with symptoms of pain or discomfort, however, it is hypothesized that these cases may progress and affect more than - of the dental width.

Methods

This case series investigated 15 panoramic radiographs of patients who presented with abnormal radiolucent intra-coronal zones or PIR lesions within unerupted teeth. Once the affected teeth were confirmed, an observer scored the PIR lesion according to an established classification system which assessed the landmarks and ratio in which resorption occurred. Statistical correlations between the severity of resorption and sex, age and affected teeth were assessed.

Results

Twenty cases of PIR lesions were observed amongst the 15 subjects investigated with 75% of cases being located in the maxillary teeth. In 70% of cases the lesions mostly presented in molars and premolars. Resorption was detected in the dentin or near the pulp of the tooth in 95% of cases with the majority of PIR cases exhibiting lesions in > $^{2}/_{3}$ of the dentine. Most cases exhibited high severity resorption.

Conclusion

Further understanding of the progression and diagnosis of this defect can assist experts in understanding its aetiology and advice on the most effective treatment plan for patients.

Authors' information
1. Jade Naicker, Department of Anatomy, Faculty of Health Sciences, School of Medicine, University of Pretoria, Gauteng, 9 Bophela Road, South Africa, Andre.Uys@up.ac.za
2. Chané Smit, Department of Oral and Maxillofacial Pathology, Faculty of Health Sciences, School of Oral Dentistry, University of Pretoria, Gauteng, Steve Biko and Dr Savage Rd, South Africa, Chané.Smit@up.ac.za
3. Andre Uys, Department of Anatomy, Faculty of Health Sciences, School of Medicine, University of Pretoria, Gauteng, 9 Bophela Road, South Africa, Andre.Uys@up.ac.za

Corresponding author:
Name: Jade Naicker
Email: Naicker.jade@up.ac.za
Telephone: 012 319 2540
Postal address: Dr Savage Road, Prinshof 349-Jr, Pretoria, 0084
Basic Medical Sciences building, Room 3-17
Prinshof Medical Campus, University of Pretoria, South Africa

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Keywords
External resorption, unerupted teeth, resorption classification

INTRODUCTION

Pre-eruptive intra-coronal resorption (PIR) is described as a resorptive defect, occurring in the crown of unerupted or impacted teeth, usually along the dento-enamel junction.[1] The defect is detected radiologically as a radiolucent region close to the central or mesial aspect of the coronal dentine.[2] Pre-eruptive intra-coronal resorption is typically asymptomatic; however, pain and swelling can be present. Therefore, cases of PIR are inadvertently detected incidentally during routine radiographs.[3]

The prevalence of PIR is reported to range from 2% to 8% among patients and from 0.6% to 2% among teeth.[4] Pre-eruptive intra-coronal resorption primarily affects the first maxillary molar followed by the second and third mandibular molars. However, higher rates are found in maxillary molars and canines and mandibular molars of older patients.[5] The prevalence of PIR may be affected by the radiographic tool used as detection is variable among different imaging modalities. Intra-oral radiography and cone beam computed tomography (CBCT) scanning are considered more reliable detection tools compared to others.[5,6] The skill of the investigator may also affect PIR diagnosis as the lesion is more perceptible to senior, experienced professionals.

The prevalence of PIR has no sexual predominance; however, age may play a role as there is an increased rate of erupted teeth in older demographics. Various studies examine younger patients for the presence of PIR using radiographic investigation. However, there is limited research regarding the presence and classification of PIR among the adult population.[1-3,6-8] The aetiology surrounding the development of this pre-eruptive anomaly is uncertain. Researchers have theorised that PIR lesions may be the presentation and development of occlusal caries prior to eruption.[1,9] Once erupted, microorganisms then have an opportunity to invade the affected tooth causing exaggerated destruction to the existing defect.[1,4] The relation between PIR and caries is highly speculated due to their close resemblance and clinical presentation, and are sometimes referred to as "pre-eruptive caries" in combination with the preferred term of "pre-eruptive dentin defect".[10] Researchers have also proposed that PIR may be influenced by ectopic positioning of teeth. This may affect the eruption of the affected tooth and place pressure on surrounding teeth.[11] These adverse effects may initiate erosion of the tooth, leading to PIR or occlusal caries. Instances of PIR spreading beyond the coronal dentine have been documented, with some patients exhibiting root involvement and more than two-thirds of coronal dentine affected. Resorption has also been reported to extend to more than two-thirds of dentin thickness in nearly half of PIR cases.[7] Progressive cases of resorption can lead to

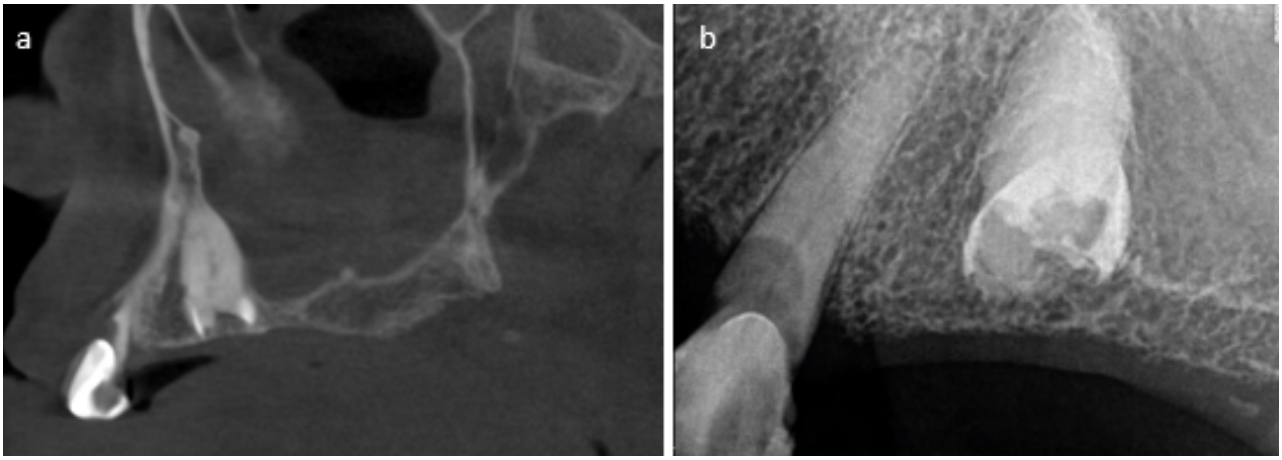

Figure 1: A sagittal CBCT image **(a)** and intra-oral radiograph **(b)** shows resorption of a left maxillary 2nd premolar.

symptoms of pain and discomfort in patients. Therefore, it is crucial to conduct additional research on the detection of PIR using dental radiographs. The aim of this study was to categorise cases of PIR according to standardised methods of classification already established. This research can provide valuable insight into the defect and analysing its correlation to factors such as patient age, affected teeth and medical history. The classification of resorption can assist in creating effective treatment options for patients before any symptoms occur.

MATERIALS AND METHODS

Cases exhibiting radiological signs of PIR on panoramic radiographs between December 2007 and June 2023 were selected from a digital radiological database. Radiographs were analysed using Cliniview© software (for radiographs taken on an Instrumentarium unit) and Sidexis© software (for radiographs taken on a Sirona unit). Subjects were chosen as they presented with unexplained radiolucent lesions in the coronal aspect, enamel and/or root dentine of both maxillary and mandibular unerupted teeth. Only affected teeth that did not penetrate the occlusal surface of the gingiva and have not entered the oral cavity were classified as unerupted and could therefore be classified as PIR. The demographics of the patients were documented and included patient age, sex and medical history, if present. Cases exhibiting PIR in erupted teeth were excluded from the study.

Once the presence of radiolucent lesions was identified in unerupted teeth and PIR was confirmed, the lesions were graded according to the classification system compiled by Yüksel et al.[5] This classification system assessed the landmarks on the tooth which was affected (enamel, dentine and/or root). Along with the landmark involved, the ratio of the area of dentine that the resorptive defect occupied in relation to the area of the dentine as a whole was also observed and graded accordingly ($<^1/_3$, $^1/_3$- $^2/_3$, $>^2/_3$). The combinations of all three landmarks and ratios led to 15 PIR scores which were employed for each case of PIR in the current study. Where available, CBCT scans were used to confirm the PIR scoring or at least the presence of intact enamel, although this was not done for all subjects as accessibility to CBCT scans are limited (Figure 1). Any correlation between the PIR cases and the systemic medical history of the patients was evaluated. Additionally, variations in PIR cases were documented. The severity of PIR cases were assessed according to the landmark affected and the ratio of resorption exhibited in the dentine. Therefore, cases with resorption in the enamel and/or $<^1/_3$ of the dentine were considered low severity. Cases involving resorption of $^1/_3$- $^2/_3$ of the dentine with or without enamel involvement were earmarked as moderate severity. While resorption in $>^2/_3$ of dentine and/or the root was noted as high severity. Correlations between the frequency of cases, sex, the average age and the affected tooth and the severity of PIR resorption was evaluated using a Chi-square test. Differences between males and females and sides were assessed using a t-test.

The observations and grading were conducted by a qualified dentist with 20 years of experience in oral and maxillofacial radiology. Ethical approval was obtained from the Faculty of Health Sciences Research Ethics Committee (132/2024).

RESULTS

Twenty PIR lesions were observed among the 15 subjects. The average age of the patients was 39 years (range: 11-75) and consisted of 8 males and 7 females. Among the subjects in the study, 40% were diagnosed with hypertension, while the remaining subjects were generally healthy. The occurrence of PIR lesions were predominantly found in the maxillary dentition, accounting for 75% (n=15) of lesions. In the maxilla, the central incisors, canines, 2nd premolar and 3rd molar were affected by PIR (Figure 2). Additionally, 60% (n=12) of all lesions were observed on the left side of the jaws. PIR lesions were seen to predominantly affect molars and premolars which resulted in 70% (n=14) of all lesions with the 3rd maxillary molar having been affected in 50% (n=7) of these cases (Figure 2). This was followed by the affected canines and incisors which resulted in 30% (n=6) of all lesions with affected maxillary canines contributing to 67% (n=4) of these cases.

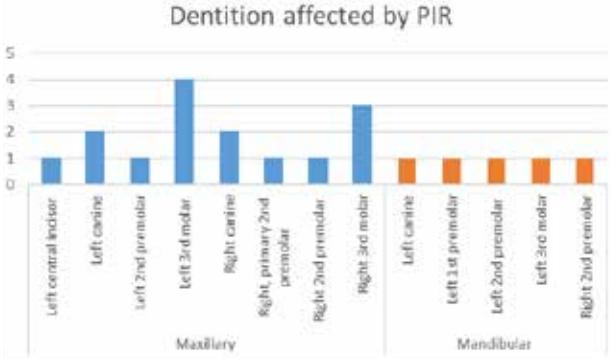

Figure 2: Number of mandibular and maxillary teeth affected by PIR lesions.

Pre-eruptive intra-coronal resorption affected the dentin or pulp in the majority of cases 95% (n=19). Lesions within the dentin eroded >$^{2}/_{3}$ of the dentinal width in 35% (n=7) of cases, as seen in Table 1. In 65% (n=13) of cases, PIR was observed in the enamel, while 60% (n=12) of cases showed resorption in both the enamel and dentine. Root resorption was present in 40% (n=8) of cases. PIR lesions affecting >$^{2}/_{3}$ of the dentine, the enamel and between $^{1}/_{3}$-$^{2}/_{3}$ of dentine (Figure 3) as well as dentine and <$^{1}/_{3}$ of the root (Figure 4) had the highest incidence of PIR scoring among the affected teeth (Table 1).

Table I: Subject demographics and PIR scoring of affected teeth
Key: M: Male, F: Female

Age	Sex	Medical history	PIR scoring	Affected tooth/teeth
11	M	Healthy	Enamel	Left mandibular first premolar
			Enamel and dentine <$^{1}/_{3}$	Left mandibular 2nd premolar Right mandibular 2nd premolar
15	M	-	Dentine and root <$^{1}/_{3}$	Right maxillary 3rd molar
			Dentine $^{1}/_{3}$ - $^{2}/_{3}$	Right, primary maxillary 2nd premolar
20	F	-	Dentine and root <$^{1}/_{3}$	Left maxillary canine
20	M	-	Enamel and dentine >$^{2}/_{3}$	Left maxillary central incisor
23	M	Healthy	Enamel and dentine >$^{2}/_{3}$	Right maxillary 2nd premolar
24	F	Healthy	Dentine >$^{2}/_{3}$	Left maxillary 3rd molar
39	F	Healthy	Dentine and root <$^{1}/_{3}$	Left maxillary 3rd molar
39	M	Hypertension and diabetes	Enamel and dentine $^{1}/_{3}$ - $^{2}/_{3}$	Left maxillary 3rd molar
40	F	Healthy	Enamel and dentine $^{1}/_{3}$ - $^{2}/_{3}$	Left mandibular canine
40	M	Healthy	Enamel, dentine and root $^{1}/_{3}$ - $^{2}/_{3}$	Right maxillary 3rd molar
56	M	Hypertension	Enamel, dentine and root >$^{1}/_{3}$	Right maxillary 3rd molar
59	F	Hypertension, diabetes and high cholesterol	Enamel, dentine and root <$^{1}/_{3}$	Right maxillary canine
62	F	Hypertension and high cholesterol	Enamel, dentine and root >$^{2}/_{3}$	Left mandibular 3rd molar
			Enamel, dentine and root <$^{1}/_{3}$	Left maxillary 2nd premolar
64	M	Hypertension, diabetes and high cholesterol	Enamel and dentine $^{1}/_{3}$ - $^{2}/_{3}$	Left maxillary 3rd molar
75	F	Hypertension	Dentine > $^{1}/_{3}$ - $^{2}/_{3}$	Right maxillary canine Left maxillary canine

Figure 3: Cropped panoramic radiograph depicting a right maxillary 3rd molar with resorption of enamel and dentine between ⅓⅓of the dentine.

Figure 4: Cropped panoramic radiograph depicting a 3rd maxillary molar with resorption of dentine and <⅓of the root.

The majority of cases (65%) presented with high severity of resorption involving the root and/or >$^2/_3$ of the dentine. Only one adolescent subject (11 years) exhibited low severity resorption in the enamel and <$^1/_3$ of the dentine. While the average age of subjects who demonstrated moderate and high severity resulted in 40 and 44 years, respectively. A t-test comparing the mean ages between moderate and high severity groups indicated no significant difference in age (p=0.72). While 44.44% of female subjects presented with high severity resorption, a Chi-square comparing the number of males and females per severity group indicated no significant differences (p=0.26). Chi-square tests comparing the cases observed on the left and right sides per severity group and the tooth involved per severity group showed no significant differences with a p-value of 0.72 and 0.18, respectively. However, a significant difference was exhibited between mandibular and maxillary teeth involvement per severity group (p<0.01) as 60% of maxillary teeth presented with high severity resorption. It is also noted that twice the number of hypertensive subjects presented with high severity resorption compared to those with moderate severity.

DISCUSSION

Pre-eruptive intra-coronal resorption is caused by the resorption of calcified tissue which results in a radiolucent defect detectable on radiographs. The presence of osteoclasts and multinucleated giant cells has been reported in samples of teeth affected by PIR.[2] This, along with observations of scalloping along the perimeter of the PIR lesion, which was also observed in the current study, is indicative of a resorptive process rather than a carious lesion. Although the cause of such resorptions is uncertain, the mechanism of resorption can determine the progression of PIR lesions and indicate possible aetiologies. Resorptive cells such as osteoclasts and macrophages from neighbouring teeth are said to travel through fissures in the dental follicle and enamel or cementum.[2,7,12,13] Resorption caused by these cells remains undetected and asymptomatic prior to eruption, which explains the often "incidental" discovery of PIR lesions on radiographs. Once the affected tooth erupts, microbes within the oral cavity invade the lesion, leading to further deterioration of the tooth. The affected tooth presents comparably to normal caries, which is a more commonly diagnosed pathology. The absence of bacteria in these defects suggests that their aetiopathogenesis is different.[2]

Although there is little evidence that may indicate PIR is related to the systemic history of the patient, many have theorised there could be a correlation due to the unknown aetiology of the defect, while other studies dispute its association.[7] The subjects in the current study did not present with any major systemic pathology that would result in adverse resorptive lesions in the dentition, with a history of hypertension documented for 40% (n=6) of the patients, while the majority of patients were relatively healthy. However, twice the number of patients (n=4) with a history of hypertension exhibited highly severe resorption as opposed to those who presented with moderate severity. Similarly, the study by Yüksel et al reports cases of hypertension and diabetes in 7.3% (n=12) and 6.1% (n=10) of subjects respectively, while the majority of patients did not exhibit systemic disease.5 These findings suggest that further research is needed regarding the involvement of systemic disease in the causation of PIR lesions or its correlation to the incidence of PIR in adult patients.

External resorption and developmental abnormalities are among some of the common local factors speculated to cause PIR lesions, along with ectopic eruption or positioning of teeth.[2,11,14] Reports suggest that ectopically positioned teeth cause additional pressure to the tooth or surrounding teeth, resulting in occlusal fissures in the dentine.[7] A substantial correlation was seen between the presence of PIR lesions and ectopic positioning, with lesions expanding to more than $^2/_3$ of the width of the dentin thickness.[7]

Due to this progression, PIR lesions are sometimes referred to as "pre-eruptive caries". Similarly, to PIR lesions, occult caries require radiographic or clinical diagnosis, with as many as 50% of cases remaining undetected.9 Occult caries also present in patients of an older age range with 50% of cases arising from patients who are 20 years old, which may be due to later eruption. Forty percent (n=6) of subjects in the current study were 24 years and younger, with many of the older patients having exhibited additional cases of occult caries, which may support this claim. However, there is a greater chance that teeth affected by PIR have already been treated or extracted during earlier examination in older populations which may translate to a decreased incidence in older subjects who have received dental care previously.15 Further histopathological investigation of PIR cases confirms the presence of chronic inflammation and haemorrhagic necrosis, whereas investigation of occult caries revealed a low likelihood of lesions arising following infection or demineralisation. These reports suggest a strong contrast between PIR and caries defects.[6,16-19]

Research indicates that PIR tends to occur more frequently in older patients, particularly affecting maxillary molars, canines and mandibular molars. This pattern was also observed as the predominant trend across all age groups in the present study. Possible reasons for this trend in older subjects could be due to the fact these teeth remain impacted for longer periods compared to the rest of the dentition. There is also a significant difference in the rate of PIR in mandibular third molars compared to maxillary third molars which may be due to the frequent extraction of mandibular third molars in patients who experience symptoms related to the impacted tooth.5 However, there are scarce histological and microbial findings that these occult lesions exhibited resorption in their pre-erupted state. Although radiographic evidence has supported these claims in studies that have compared radiographs of affected teeth before and after eruption.[6, 20]

Due to the affected teeth being impacted, detectability through intra-oral examinations is impossible and radiographic diagnosis is needed. Although panoramic radiographs provide fair visualisation, they do not perform as efficiently compared to other modalities such as intra-oral radiographs.[6,7] While CBCT scans provide the most accurate assessment of the positioning and dimensions of the width of the lesion, however, this diagnostic may not be as accessible as plain radiography.5 A study comparing the prevalence of PIR using both panoramic and bitewing radiographs shows a discrepancy of 6% subject prevalence and less than 2% tooth prevalence, with bitewing radiographs proving to be a more effective mode of detecting PIR cases.[7]

Resorption is prominently seen in impacted maxillary molars and premolars which are not distinctive during radiographic rendering which makes diagnosing these pre-eruptive

defects difficult and can be the reason behind inconsistencies in the prevalence of PIR between studies. However, additional factors may contribute to these differences including differences in the sample sizes, demographic and geographical location, as well as the level of experience of the observer identifying PIR cases. A study by Yüksel et al reported that dental professionals with more than 20 years of endodontic experience have a high proficiency and are more inclined to detect resorptive lesions on radiographs when compared to specialists with less experience.[5] This, in turn, may affect the diagnosis of PIR cases, especially when paired with radiographic tools which provide poor visualisation.

Treatment options for patients with PIR are administered according to the size and progression of the lesion. We can conclude from the current study that the locality of resorption can extend from the coronal dentition to the root and pulp and resorption can be static or active.[8] The current study also observed a high incidence of cases with high severity resorption which may indicate a need for suitable intervention. Clinical studies have revealed that surgical exposure and restoration were needed in large, active lesions and monitoring and restoration were administered for small, static PIR lesions.[2,17] Tooth extraction seems to be the most effective treatment option for large lesions. Although preventive, non-invasive measures which limit the rate of resorption and the size of the lesion such as restoration, root canal therapy, monitoring and observation of small static lesions, are favoured.[2,17] These passive treatment options at the early stages of lesion development also avoid the progression of resorption and fracturing of the tooth, as well as the need for invasive therapy such as extraction.

The rate of eruption should also be monitored in PIR cases, as erupted teeth are prone to fissure caries and oral microbes which can exacerbate the advancement of lesions, resulting in the patient presenting with symptoms of pain and discomfort.6 Therefore, treatment plans need to be revised and assessed according to the size and development of the PIR lesion and the rate of eruption with the immediate administration of preventive therapy such as restoration, before invasive extraction options. This also includes the importance of early detection and surveillance during the pre-eruptive stages, especially of the coronal dentin. The use of CBCT scans provides valuable details regarding the locality and width of PIR lesions and is the optimal tool for diagnosis. These records also assist in generating effective treatment regimens and monitoring thereof.
Further awareness of the pre-eruptive defect and research regarding the prevalence of resorption in various demographic groups is needed to understand the cause of these lesions and develop early detection mechanisms for patients. Treatment of these lesions before symptoms arise is necessary for creating optimal patient care and preventing invasive therapy options.

Limitations

CBCT scans of the subjects could not be utilised in all cases as a control in this study for the validation of the presence and scoring of the PIR lesion, due to the lack of availability of CBCT scans.

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Author contributions

JN: Formal analysis, investigation, writing – original draft preparation.
CS: Conceptualisation, writing – review and editing.
AU: Conceptualisation, investigation, writing – review and editing.

Conflict of interest

The authors have no conflict of interest to declare.

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What's new for the clinician – summaries of recently published papers (November 2024)

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

1. THE SINGLE MANDIBULAR IMPLANT STUDY – IMPACT ON DIETARY HABITS AFTER 5 YEARS OF OBSERVATION IN PATIENTS WITH IMMEDIATE AND DELAYED LOADING PROTOCOLS

Currently, the standard of care for patients who are edentulous and reside in mainly developing countries is a set of conventional complete dentures.[1] The retention and stability of these dentures is highly influenced by the existing anatomical supporting tissue, the adjusted tooth set-up and a targeted extension of the denture base into the muscular functional spaces.[1] Due to atrophy of the mandible and reduced supporting tissue compared to the maxilla, there are limits regarding a sufficient retention and stability of complete dentures in the mandible, which can directly influence dietary habits and patient comfort.[1]

The use of oral implants has been found to increase the stability of these prostheses.[1] As early as 2002, the Mc Gill Consensus Statement set implant-supported complete dentures on two implants to be the standard and first-choice therapy for the treatment of edentulous mandibles. Unfortunately, the cost of implant placement made this viable only in the well-resourced developed countries.

For prosthetic and anatomical reasons, the intraforaminal region is an excellent position for a simple implant insertion. The absence of a nerve canal and adequate vertical residual bone height even in advanced atrophy are advantageous.[1] Suitable retention elements such as ball anchors, bars and magnets can be used to allow direct attachment to the prosthesis.[1] In some cases, existing prostheses can be modified in this process, even avoiding the need to fabricate a new prosthetic restoration.

A comparison of conventional complete dentures with implant-supported dentures on two implants has shown significant improvement in patients' comfort, oral health-related quality of life, denture stability, phonetics and, finally, increased masticatory efficiency.[1] Depending on the time after implant placement, the implants can be loaded immediately or with a delayed loading. Loading is defined as the direct occlusal contact of the implant-supported denture with the antagonistic opposite dentition.[1]

The retention of complete dentures using only one centrally placed implant in the mandible has also been investigated and demonstrated similar improvement performance to implant-supported dentures on two implants. Similar to the investigations with two implants, studies revealed an improvement in patient satisfaction, oral health-related quality of life and patient comfort.[1] In addition, a significant improvement in masticatory efficiency can be observed here. Blender and colleagues (2024)[1] reported on a trial that sought to investigate the influence of the loading protocol of the implants on a possible change in the dietary habits of patients after a midline implant was inserted in the mandible to support the existing complete denture.

Methodology

This was a prospective multicentre randomised clinical trial conducted at nine study centres in Germany. Edentulous patients between 60 and 89 years with sufficient and technically acceptable complete dentures in the maxilla and mandible were included, whereby the retention and/or stability of the mandibular denture was assessed as insufficient by the patients. If a new mandibular prosthesis was fabricated, it had to be in situ for at least 3 months to allow adaptation by the patient. For the placement of a single midline implant in the mandible, the residual bone height at the lowest vertical height of the mandible had to range from 11mm to 20mm (according to Mc Garry et al. type II or type III) and the vertical bone height at the midline of the mandible had to measure at least 13mm.

After completion of the screening of potential study patients, a total of 163 patients received a single midline mandible implant (3.8mm x11mm implant). Of these, 158 patients could be randomised into the two study groups. Randomisation took place at the time of implantation directly after insertion of the implant and determination of the implant stability. The insertion torque had to be at least 30 Ncm and the ISQ value had to be ≥60.

To determine the ISQ value, a Smart Peg attachment (type 23) was screwed hand-tight onto the implant (2-4 Ncm) and the implant stability was measured in mesio-distal and vestibular-oral direction using resonance frequency analysis (Osstell ISQ, Gothenburg, Sweden). The implants of patients in group A (n = 81) were loaded immediately, whereas in group B (n = 77) a delayed loading was performed after a defined healing period of 3 months. For fixation of the prosthesis with the ball attachments on the implants, the retention matrices were inserted into the existing mandibular prosthesis with a self-curing bis-acrylate resin, using the chair-side technique.

In order to assess the influence of the implant loading protocol on changes in nutrition intake over time, a corresponding dietary questionnaire was created for the study. This questionnaire was completed by the patients in both study groups at four defined time points: (1) baseline examination before randomisation and implantation, (2) 12 months after implant loading, (3) 24 months after implant loading and (4) 60 months after implant loading.

The first part of the dietary questionnaire was aimed at the patients' nutrition intake. The patients were asked to document how frequently certain foods were consumed. Nine foods and three alcoholic beverages were recorded.

There were seven possible answers ranging from "1 – rarely or never" to "7 – two or more times a day". According to the consumption frequency, the patient could enter the corresponding answer option with a number behind each food.

In the second part of the nutrition questionnaire, the patients were asked whether they actively avoided certain foods as a result of the existing dentures. Eleven foods with different consistencies and textures were submitted to the patients. This time, the patients had to specify whether they consciously actively avoid these foods in their diet due to the presence of the denture. Simple "yes" or "no" answers were possible.

Results

During the five-year follow-up, 50 patients in group A and 51 patients in group B were re-examined, with one patient in group B having an implant loss. The number of patients in group A and group B was reduced to 47 and 45, respectively, since dietary questionnaire data were available for these patients at all four examination times. For the foods beef, pork, unprocessed cereals (brown rice, cereal, oatmeal etc), wholegrain bread and the alcoholic beverages beer, wine and liquor, neither intergroup nor intragroup differences were observed throughout the study period. At baseline, only the consumption of fresh fruit showed a significant difference between the food intake of the two groups ($p=0.013$). This trend was also observed at 12-month ($p=0.020$) and 60-month ($p=0.045$) follow-up, while there were no significant intragroup changes in food intake over time in either group. In this context, group B showed an increased intake of fresh fruit at baseline and at all significant follow-up periods.

For poultry (chicken), a significant difference was observed between the two groups after 24 months of loading ($A<B$; $p=0.031$). Thereby, a significant increase in the consumption of poultry ($p=0.003$) was observed in group A when comparing the baseline examination with the examination after 24 months after loading. For red and yellow vegetables (raw or cooked), a significant difference between the groups was recorded after 24 months ($A<B$; $p=0.032$). Here, the consumption habits in group B changed significantly over the course of the study ($p=0.002$), whereby the comparison between the baseline examination and the follow-up examination after 24 months was significant ($p=0.002$). The consumption of raw food 12 months after loading demonstrated a significant difference between the two groups ($A<B$; $p=0.042$). The time course within group A showed significant differences in comparison ($p=0.047$). Thereby, the consumption behaviour of raw food in group A increased significantly not only after 12 months ($p=0.016$), but after 24 months ($p=0.022$) as well. In addition, a significant increase in the consumption behaviour of raw food in group B was observed after 24 months ($p=0.009$). Although no differences in the consumption of leafy vegetables (raw or cooked) were observed between the groups, at least the time course in group B showed a significant change ($p=0.005$): In this case, the frequency of consumption showed a significant increase of consumption between the baseline examination and the examination after 24 months ($p=0.019$).

When the issue of **the avoidance of certain foods was investigated,** significant intergroup differences between the two groups at the time of baseline were only evident for apples with peel. Whereby more subjects avoided apples in group A ($n=30$; 63.8%), compared to group B ($n=14$; 31.1%). However, over the 60 months after loading, this difference between the two study groups became non-significant. Similar results are observed for the remaining 10 foods. Again, no significant differences were observed between the two groups at any study times during the first 60 months.

CONCLUSION

The researchers found that any changes in the patients' dietary habits due to the insertion of a single midline implant in the mandible to support the existing complete denture was not observed, regardless of the loading protocol.

Implications for practice

Improving the chewing efficiency by single midline implants in the edentulous mandible does not lead to a change in dietary habits.

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2. IS THERE AN ASSOCIATION BETWEEN SALIVARY IMMUNE AND MICROBIAL PROFILE WITH DENTAL HEALTH IN SYSTEMATICALLY HEALTHY CHILDREN?

Salivary diagnosis is a growing field, with identified markers associated with cancer, cardiovascular diseases, autoimmune diseases, viral and bacterial diseases, and human immunodeficiency.[1] One growing field in salivary diagnosis is its inflammatory profile as a potential marker for childhood illnesses, albeit with little attention to its profile in health and the impact of focal conditions, such as caries and gingivitis, on its composition.[1]

Caries and gingivitis are common oral microbial conditions in systemically healthy children. Thus, the local oral environment in such conditions potentially affects focal inflammatory and microbial salivary cytokines. In such cases, salivary inflammatory and microbial profiles may alter and should be considered when using saliva to examine health and disease.[1]

Several types of inflammatory biomarkers are associated with oral diseases in saliva.[1] Cytokines are among the most investigated biomarkers in this context due to their involvement in inflammatory, infectious and immunological diseases.[1] One salivary cytokine that has been studied in caries and gingivitis is interleukin-1 beta (IL-1β), indicating that it may be involved in the development of such conditions. Other studies have investigated the role of other salivary cytokines, such as tumour necrosis factor-alpha (TNFα) and interleukin-8 (IL-8), which are also involved in the immune response and contribute to the inflammatory process associated with caries and gingivitis.1 Evidence shows that such diseases can be detected in adults through saliva biomarkers, such as interleukins IL-1β, IL-6, IL-8, and IL-10, TNFα, and matrix metalloproteinases (MMP)-8 and IL-9.1

Davidovich and colleagues (2024)1 reported on a study that sought to characterise the inflammatory and microbiological profiles of the saliva of systemically healthy children and to

associate those levels with a clinical diagnosis of caries and gingival disease.

Materials and methods

The study population comprised 100 children systemically healthy born during 2008-2016 (aged 4-12 years at the time of the study). Children with no previous relevant medical history and no medications on a regular basis. The inclusion criteria were systemically healthy children who did not take any medications and the children's and their guardians' agreement to participate in the research. The exclusion criteria were children undergoing orthodontic treatment and children who did not fast before the saliva collection appointment.

Dental examinations were conducted by one dental student using a dental mirror, a dental explorer and a dental probe. It included the following parameters:

- Oral hygiene – measured by the plaque index (PI) with a range of 0 (no plaque) to 3 (abundant plaque) and presented as an average for all sites, only on buccal surfaces. (0 – No plaque is in the area adjacent to the gingiva; 1 – There is a plaque in the form of a thin film on the gingival margin; 2 – There is a visible plaque in the gingival pocket and gingival margin; 3 – There is a dense plaque in the gingival pocket and on the gingival margin).
- Periodontal status – measured by the gingival index (GI) using a periodontal probe and with a range of 0 (no bleeding) to 3 (spontaneous bleeding) and presented as an average for all sites (0 – Healthy gums; 1 – Mild discolouration and oedematous gingiva. No bleeding on probing; 2 – Red, oedematous and shiny gingiva. There is bleeding on probing; 3 – Red, oedematous and ulcerated gingiva. There is spontaneous bleeding).
- Caries status – measured by the DMFT/dmft index (D=decay, M=missing, F=filling; T per tooth) in permanent/primary dentition and presented with a range of 0 (very low DMFT) to above 6.6 (very high DMFT) and presented as an average for all sites. All the values were collected and recorded in a data table.

Saliva was collected in a quiet room between 08:00 and 12:30h. The children refrained from eating, drinking, brushing their teeth or rinsing with mouthwash for at least 1h before spitting. Immediately after clinical examination, the children were asked to collect saliva in their mouths and spit it into a sterile wide test tube for 3min. The saliva was immediately stored at 4°C without any additives and further kept at -80°C until analysis. The data were collected on paper charts, which were transferred to a computer program.

Bacterial DNA was extracted from saliva using a DNA extraction kit. The DNA was then tested using specific primers for the total bacteria – *S. Mutans*, *Lactobacillus species* and *Fusobacterium nucleatum* – using SYBR-Green-based quantitative real-time PCR.

The Bradford Coomassie Assay (BCA) was used to quantify the total salivary protein levels according to the manufacturer's instructions. In brief, a standard curve was prepared using bovine serum albumin. All samples (standards and saliva samples) were then incubated with the BCA working reagent in a 96-well microplate at 37°C for 30min to allow colour development that was measured at a 562nm wavelength using a microplate reader.
The salivary levels of human TNFα, IL-10, IL-8 and IL-6 were measured using ELISA kits according to the manufacturer's instructions.

Results

The study included 100 systemically healthy paediatric patients with a mean age of 8.08±0.23, 49% of whom were female. 28 children were between 4-6 years old, 62 were between 6-11 and 10 were between 11-13 years old. There was no statistical difference between males and females. The mean DMFT for the cohort was 2.64±0.31, the mean GI score was 0.51±0.06 and the mean PI score was 1.33±0.07.

The mean DMFT level was significantly lower in the permanent dentition age group than in the other dental age groups. The highest DMFT levels were observed for the primary dentition group (aged 6 years and younger), without statistical difference compared with the mixed dentition group. The mean GI level was statistically higher in the permanent dentition group than in the primary dentition group. The mean PI did not differ substantially between the groups ($p=0.14$).

GI and PI did not differ according to DMFT. Significant associations were found of PI above 1 with DMFT and GI. Significantly higher levels of PI were found among those with GI above 0 than among those with GI equal to zero.

The mean total protein level was higher, albeit without statistical significance, in the permanent dentition group than in the other dentition groups. For those with DMFT>2, GI above 0, and PI>1 groups, protein levels were modestly higher than in the comparative groups, although these comparisons were without statistical significance.

The levels of the inflammatory markers IL-10 and IL-6 showed a positive pattern according to age without any statistical differences. IL-8 and TNFα did not show age-dependent patterns. The mean levels of the inflammatory markers examined were higher among those with DMFT>2 than DMFT≤2; the difference was statistically significant only for the IL-8 level. IL-6 and TNFα were significantly higher among those with plaque>1 than plaque≤1. No statistically significant associations were observed between cytokine levels and GI.

S. Mutan was undetectable in the saliva of all cases. The total bacterial load was significantly higher for the mixed dentition group than for the permanent dentition group. The other stratifications did not show statistically significant differences in bacterial load.

Conclusions

Researchers found that there was a higher level of IL-8 among those with DMFT>2 than DMFT≤2. There were higher levels of IL-6 and TNFα levels among those with plaque>1 than plaque≤1. The high presence of inflammatory cytokines may reflect dental caries status in children.

Implications for practice

Salivary analysis has the potential to provide values information on caries, gingival and periodontal risk among children.

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Everything you need to know about dental records

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Mr P Govan – Head of legal, SADA head office

INTRODUCTION

Many practitioners, practice managers, and staff often have inquiries regarding dental records. They ask questions such as: "What is the retention period for patient records?" "Are study models included in dental records?" "Should we retain all records when our practice space is limited?" "Does the POPI Act apply to dental records?" At times, they also inquire about the possibility of disposing of records to free up space.

Nevertheless, many dentists, staff members, and managers lack clarity on how to manage these records and when it is appropriate to discard them.

The maintenance of dental records is fundamental for effective patient management and is regarded as both an ethical and legal responsibility of the dentist. Ethically, it fulfills the duty of care owed to the patient by the dentist, while legally, it serves as protection against potential medico-legal issues.

Dental records are classified as legal documents owned by the dentist, encompassing both subjective and objective information about the patient.

What is a dental record?

A dental record is a detailed document of the history of the illness, physical examination, diagnosis, treatment, and management of a patient. Dental professionals are compelled by law and ethics to produce and maintain adequate patient records.

The record comprises several elements including written notes, radiographs, study models, referral letters, dental charting, consultants' reports, clinical photographs, results of special investigations, drug prescriptions, laboratory prescriptions, patient identification information, and comprehensive medical history.

It includes subjective data (reasons for visiting the dentist, chief complaint, and symptoms), objective findings (obtained from clinical examination and diagnostic tests), assessments (diagnostic and therapeutic judgments based on the subjective data and objective findings), and treatment plans (various options and their costs, risks and benefits, time considerations, and so on).

A dental record usually comprises three sections:
patient information (see next);

- business information (billing details with date and amount, copies of claim forms submitted, information related to laboratory services used and their charges, scheduling of appointments); and
- drug record (condition being treated, dates and method of prescription, administration and dispensing of the drug including its name, strength, quantity, form, and directions of use).

A dental record may be used:

(i) for planning and maintaining continued patient care;
(ii) for documentary evidence of the evaluation and diagnosis of the patient'scondition, the treatment plan and informed consent, the treatment actually rendered, recalls and referrals made, and the follow-up care provided;
(iii) to monitor the success or failure of treatment carried out, as well as to monitor the patient's oral health and assist with oral health promotion and preventive practice;
(iv) to document all communications with the patient, whether written, verbal, electronic, or telephonic;
(v) as a record of communication regarding the patient and other healthcare providers, as well as interested third parties;
(vi) to protect the legal interests of all parties involved;
(vii) to provide data for continuing dental education, training, and research; and
(viii) for billing, quality assurance, and other administrative functions.

Records can also be used for communication with other practitioners or specialists for second opinions. They are indispensable as direct evidence against litigation or complaints lodged by patients in the event of malpractice lawsuits as well as medical scheme audits for utilization and clinical audits.

What makes a good record?

To keep things simple, try thinking in terms of the 4 Cs.

Contemporaneous: make a record as soon as possible after a patient interaction.

Clear: record your findings carefully (and legibly if not using a computer) so that they can be understood by anyone who may need to read and interpret them. For example, avoid abbreviations as far as possible and use one system of dental charting. It should be clear who made an entry and when.

Complete: It should where appropriate consist of all relevant clinical findings, including (but not limited to): -

- Who is making the notation in the patient health record (this is particularly important when multiple healthcare professionals are responsible for a patient health care record);
- The times of consultation and other clinical interactions;
- The full clinical history;
- The clinical examination;
- The differential diagnosis;
- The information and advice given to the patient;
- The clinical decisions made and when and who made such decisions;
- The decisions and actions agreed to and when these were agreed to;

- When required the written affirmation of such agreements (consent forms);
- The treatment administered (including detailed operation or invasive intervention notes when such a procedure has taken place):
- The drugs and doses of drugs given;
- The investigations ordered and their results and dates when ordered and when results have been received;
- Future appointments and referrals made;
- Any other documentation relevant to a patient's health.

The interactions that need to be recorded in a patient health record include (but are not limited to): -
- The face-to-face discussions between the patient and a health practitioner;
- Progress notes when a patient is seen for review regarding a specific episode of care (e.g. while a patient is in hospital or when a particular condition requires follow-up);
- Any virtual, telephonic or similar discussions and/or consultations with the patient and their relatives;
- Discussions with colleagues related to the patient;
- All correspondence related to the care of a patient.

The compulsory elements of a patient health record are: -
- The personal (identifying) particulars of a patient;
- The full biopsychosocial history of a patient, including allergies and idiosyncrasies;
- The time, date and place of consultation;
- The assessment of the patient;
- The proposed management of the patient;
- The medication and dosage prescribed;
- Details of referrals to specialists and other healthcare professionals;
- The patient's response to treatment, including adverse effects;
- Investigations ordered and their results;
- Details of the times that a patient was booked off work or similar activities and the relevant reasons;
- Written proof of informed consent when this is relevant.

Concise: records should be just long enough to convey the essential information. It should not contain superfluous personal comments or derogatory remarks regarding the patient.
that could backfire if someone else needs to access the record.

Alteration of patient health records

Late and additional entries must be dated and signed in full, when made in an electronic format, they must be fully attributable to the person making such a change. The reason for an amendment or error must be specified on the record.

Any error or incorrect entry discovered in the record may be corrected by placing a line through it with ink and correcting it. The date of change must be entered and the correction must be signed in full. The original record must remain intact and fully legible. Under no circumstances should the note simply be deleted or torn out and thrown away.

Privacy and security of patient health records

The National Health Act [1], imposes on the owner of a practice a duty to set up control measures to prevent unauthorised access to records including those in storage. This would apply to both paper and electronic records.

Electronic data must be managed, stored and backed up using internationally accepted standards.

The Protection of Personal Information Act (POPIA) is a robust data protection legislation that safeguards individuals' personal information and privacy. Practitioners are obliged to secure integrity and confidentiality of personal information and take necessary measures to prevent loss, damage or unauthorised destruction of personal information. They must take appropriate safeguards against all identified risks.take necessary measures to prevent loss, damage or unauthorised destruction of personal information. They must take appropriate safeguards against all identified risks.

Retention of records

What does the law say about retention periods of dental records?

Is there any law that prescribes the time that dentists need to keep their patient's clinical records in South Africa?

No legislation presently prescribes the length of time that dentists must keep their clinical records, there are, however, ethical guidelines published by the Health Professions Council of South Africa (HPCSA)[2].

Patient health records should ideally be stored indefinitely, if this is not practical the following retention periods are suggested:

Patients – Stored for at least a minimum of six (6) years as from the date that a patient health record has become dormant (dormancy commences at the time when a patient was last treated by a healthcare practitioner).

Exceptions to the above rule

Minor patients – Until their 21st birthday as legally minors have up to three years after they reach the age of 18 years to bring a claim.
Mentally impaired patients – until the patient's death.
Occupational illness or accident – 20 years after treatment has ended.
Provincial hospitals and clinics – Records to be destroyed with authorisation of the Deputy Director-General.
Patients exposed to conditions that manifest in a slowly developing disease – At least 25 years.
Professional indemnity provider – Recommended retention period of a minimum of 11 years for adults.

A balance must be reached between the costs of (indefinite) retention of records and the occasional case where the practitioner's defense of a case of negligence is hampered by the absence of records.

Retention of electronic records

Storage of electronic clinical records must include the following protective measures:
- All electronic clinical records, including those stored on external hard drives, must be encrypted and protected by passwords in order to prevent unauthorised persons from gaining access to such information.
- Copies of backup hard drives must be kept and stored in a physically different site so that the two discs can be compared in case of any suspicion with tampering.
- Effective safeguards against unauthorised use or retransmission of confidential patient information is to be assured before such information is entered on the computer. The right to patient privacy, security, and confidentiality should be protected at all times. All staff should not have access to all electronic records, access must be granted on the basis of their responsibilities.

The cost and space implications of keeping records indefinitely must be balanced against the possibility that records will be found

useful in the defence of litigation or for academic or research purposes.

A person normally has three years to initiate a claim after the relevant incident took place in terms of the Prescription Act (Act 68 of 1969).

The prescription period is delayed in some cases like in the case of minors under the age of 18 years, dental records should be kept until the minor's 21st birthday. It is important to remember that prescription may even run from when the patient has knowledge of the facts giving rise to a claim.

Therefore, not only the treatment date is crucial but also the date on which the patient has knowledge (or should, by the exercise of reasonable care have had knowledge) that harm was caused by the treatment.

Practitioners would thus have to balance the costs of indefinite retention of records and the case where the practitioner's defence of a negligence case or complaint to the regulator is handicapped by the absence of such records.

Ownership and Access to Dental Records

Where records are created as part of the functioning of a private practice, including the original radiographs or ultrasound or scanned images, the dentist is the legal owner of such records and they remain solely the property of the dentist. Patients do not have the right to possess their original record, but they may request access to, or have a copy of, their dental records for various reasons.

Patients are entitled to have access and obtain information contained in the records. A copy of the records, radiographs, study models, and so on can be provided to the patient or transferred to a new practitioner on request.

The patient may be charged an appropriate fee for such copies, provided that the patient is made aware of the charges.

In the case of a deceased practitioner, the executor of his or her estate will administer dental records as well. Should the practice be taken over by another practitioner, the executor shall pass the records to the new practitioner. The new practitioner is obliged to inform all patients in writing regarding the change of ownership, and the patient can remain with the new practitioner or request that the patient's records be transferred to a practitioner of the patient's choice. Should the practice not be taken over, the executor should inform all the patients in writing and transfer those records to other practitioners designated by the individual patients. The remaining files shall be kept in safe-keeping by the executor for at least 12 months with full authority to further deal with the files as deemed appropriate, provided the provisions of the rules on professional confidentiality are observed.

Practitioners closing their practice for whatever reason (retirement, ill health, change in profession) shall within three months of closure inform all their patients in writing that date when it will close, records will be transferred to the practitioner of the patient's choice and others be kept in safekeeping for at least twelve (12) months. Although this period is mentioned in ethical guidelines, indemnity providers and insurers may require practitioners to keep it for longer in the event a complaint or claim is made.

In the event that a dentist in private practice decides to close or sell his or her practice for any reason, the practitioner shall inform in writing and in a timely manner all the dentist's patients as follows:

- That the practice is being closed from a specified date;
- That requests can be made for records to be transferred to other practitioners of the patient's choice;
- That after the date specified, the records shall be in safe-keeping for a specific period with an identified person or institution with full authority to deal with the files as deemed appropriate, provided the provisions of the rules on professional confidentiality are observed.
- That in the case of sale, the new practitioner owner will take custody of files unless they object to the transfer of their personal information. The incoming dentist should notify patients that he or she is the new owner of the practice and is now in possession of their dental records.
- Patients have the right given the right to alter or edit information if they consider it incorrect or inaccurate.

A dentist may make information available to a third party without the written authorisation of the patient or his or her legal representative in cases where, for example:

- It is demanded by the court in medico-legal cases, for example, when the dentist is a witness in a trial between a patient and another party, or where the patient has instigated action in court against the dentist, and the dentist is ordered to testify on the patient's dental condition or to produce his or her dental record.
- A professional body has instituted disciplinary hearings, and the dentist must answer the charge to defend him or herself.
- The dentist is under a statutory obligation to disclose certain facts (e.g., in the case of suspected or known child abuse).

The Promotion of Access to Information Act gives persons the right of access to any information required to exercise or protect their rights before the institution of court proceedings. These will have to be done in terms of the manual of the particular practice and should include:

1. sufficient particulars to enable the practitioner to identify the requester
2. sufficient particularity regarding the record being requested.
3. the form of access to the record required (copies or electronic format).
4. postal address or fax number of the requester.
5. how the requester would like to be informed of the decision on the request.
6. if the request is made on behalf of a person (if attorneys make the request, for example), proof of the capacity in which the person is making the request, e.g. a power of attorney or consent of the patient.

A reasonable fee may be requested in producing copies of records. The HPCSA has ruled that where the patient has paid for x-rays or images, they are entitled to request and obtain originals and the practitioner must keep copies in the patient file.

Disclosure of patient records to patients

The ethical rules of the HPCSA on disclosure of records provide:

Person 12 years or older – The practitioner can provide the patient with a copy or abstract or access to his/her dental records should they request it.

Under the age of 12 years – Information regarding the

patient may only be divulged with the written consent of the patient's parent or guardian

The parent making a request for records in respect of a patient under 16 years – Disclosure can only be made subject to the consent of the patient in terms of the Promotion of Access to Information Act

Deceased patient – May only be divulged with the written consent of the next of kin or the executor of the deceased's estate

Third-party – No dentist shall make information available to any third party without the written authorisation of the patient or his or her legal representative.

Disclosure without consent of patient/legal representatives

a) Court order records be handed over to the third party
b) The dentist is under a statutory obligation to disclose certain medical facts, for example, reporting a case of suspected child abuse in terms of the Children's Act (Act 38 of 2005).
c) A patient has instituted an action in Court against a healthcare practitioner and the practitioner needs access to the records to mount a defence
d) The third party is a healthcare practitioner who has had disciplinary proceedings instituted against him/her by the Health Professions Council and the practitioner requires access to the records to defend himself/herself.
e) Where the ailment of a patient becomes known to a dentist and the nature thereof is such that the dentist concerned thinks that the information ought to be divulged in the interest of the public at large. Before the information is divulged the relevant information should be given to the patient and voluntary authorisation should be sought from the patient

Divorced or separated parents

Disclosure of their child's records may be with the consent of the parent with full parental rights and responsibilities in respect of a child.

Where more than one parent holds the same parental rights and responsibilities in respect of a child, each of the co-holders may act without the consent of the other co-holder when exercising those rights and responsibilities, except where this Act, any other law, or a Court Order provides otherwise.

One way of dealing with the troublesome issue of consent with divorced, separated, or estranged parents is to have an office policy that requires the consent of both parents, even where there is joint legal custody of the minor. Retain a copy of the custody court order in the patient file.

Provincial hospitals

The records are kept under the care and control of the clinical manager and access to such records shall be subject to compliance with the requirements of the Access to Information Act and such conditions as may be approved by the superintendent.

Storage of dental records

Making a record is only the start of your professional responsibilities. Whether records are held on paper or electronically, you also have an ethical obligation to uphold patients' rights by making sure records are appropriately stored, shared, and disposed of. There are few if any legal obligations, however, the ethical rules provide that all records must be kept in a safe place.

The Protection of Personal Information Act, provides that you must ensure the integrity and confidentiality of the personal information under your control. This means that you must take appropriate, reasonable technical, and organisational steps to prevent the loss, damage, or unauthorised destruction of personal information or the unlawful access to or processing of information. It is no longer safe to keep patient records on an open shelf in an area of the practice where it is open to everyone in the practice.

Some of the measures to be implemented include:

- keep hard copies of records under lock and key
- implement IT security measures such as firewalls, virus protection, and encryption. Seek professional advice if necessary
- arrange regular data protection training for staff. In NHS practices, staff should know the identity of their local data protection officer
- require all staff to have individual log-in profiles and strong passwords to prevent unauthorised access to patient data. Passwords should be regularly changed and password sharing should be banned
- ensure staff only have access to the information they need to do their job
- back up electronic records regularly to protect against file corruption or accidental loss. Back-ups should be held securely off-site in case of accidental loss
- have a signed written contract with all third-party suppliers, including IT contractors, which sets out your confidentiality requirements
- keep personal and professional computers and mobile devices entirely separate, to avoid confidentiality breaches.

Paper Records

Paper records can be easily damaged by moisture, water, fire, and insects. As paper records are irreplaceable, it is a good idea to identify ways in which to safeguard them.

If you keep all your dental records in paper format, you must ensure there are systems in place to protect them in case of fire, flood, or other circumstances that could damage the records.
You must ensure you install smoke and fire alarms to allow you to act quickly in the event of a fire breaking out. Water sprinkler systems can damage electronic equipment so install chemical fire extinguishers to protect your paperwork.

Basements are not recommended for storing records as they are prone to flooding, instead, store records above floor level and ideally on a high shelf.

It is also important to conduct regular inspections of your premises and have control measures carried out by experts to keep damaging insects and rodents at bay.

Electronic Records

In the case of electronic records, they should be encrypted and safeguarded by passwords so that not all personnel have access thereto and no changes can be made.

If records are saved in the cloud or on a server, it is useful to have a backup copy that is stored off-site so records can be reconstituted if the need arises.

It is no defence to argue that records or in particular x-rays were lost due to hardware or software malfunction and that all or a portion of records were permanently lost or destroyed.

What are the legal requirements for the disposal of records?

There is no legislation prescribing how records should be destroyed. The ethical rules are also silent in this regard.

Common sense would have to prevail here and one must be mindful of the provisions of the Protection of Personal Information Act,

2013, which provides that personal information of patients must be protected at all costs when destroying records.

Records should not be disposed of in the ordinary waste or given to unregistered recyclers but rather contract a professional waste disposer. It can be incinerated by a service provider or shredded in a manner that these records or personal information cannot be reconstructed. All identifying information on casts and models must be removed prior to disposal.

An efficient records management system should include arrangements for archiving or destroying dormant records to make space available for new records, particularly in the case of paper records.

Records held electronically are covered by the Electronic Communications and Transactions Act, which specifies that personal information must be deleted or destroyed when it becomes obsolete.

The records should be examined first to ensure that they are suitable for disposal and an authority to dispose of them should be signed by a designated member of staff.

The records must be stored or destroyed in a safe, secure manner. If records are to be destroyed, paper records should be shredded or incinerated. CDs, DVDs, hard disks, and other forms of electronic storage should be overwritten with random data or physically destroyed.

Be wary of selling or donating second-hand computers – "deleted" information can often still be recovered from a computer's hard drive.

If you use an outside contractor to dispose of patient-identifiable information, it is crucial that you have a confidentiality agreement in place and that the contractor provides you with certification that the files have been destroyed.

You should keep a register of all healthcare records that have been destroyed or otherwise disposed of. The register should include the reference number (if any), the patient's name, address and date of birth, the start and end dates of the record's contents, the date of disposal, and the name and signature of the person carrying out or arranging for the disposal.

Standards of dental records

The guidelines state that:

1. No information or entry may be removed from a health record.
2. Be consistent.
3. Be complete and concise sometimes diagrams are useful.
4. Avoid self-serving, derogatory, insulting, or disapproving comments in patient records.
5. Contain notes about history, physical findings, investigation, diagnosis, treatment, and outcome.
6. An error or incorrect entry discovered in the record may be corrected by placing a line through it with ink and correcting it. The date of change must be entered and the correction must be signed in full. The original record must remain intact and fully legible.
7. Contain a line through the item that requires alteration so that the revision is visible under the line, dated, and signed. Under no circumstances should the note simply be deleted or torn out and thrown away.
8. Contain separate labels for diagrams, lab results, photographs, charts, and x-rays. Do not rely on sheets of paper bound or stapled together.
9. Be kept separate from financial or billing records.

For medico-legal purposes, the following are important to note:

1. Do not rewrite your notes as only notes written contemporaneously have any value in court. A practitioner may, however, make further notes at a later stage. These notes should be correctly dated and signed. The reason for recording the note should also be stated.
2. Where you are proposing treatment with inherent complications, a record that the patient proposed has been advised of the material risks and complications of the treatment in question. If possible, ask your patient to sign a confirmation that s/he has been warned of the material risks and complications of the treatment to which s/he has agreed. Such discussions regarding the material risks and complications of a procedure should take place well in advance of the date of the proposed treatment so that the patient has time to digest and consider the information conveyed
3. Practitioners should note any discussions with patients regarding fees or fee estimates.

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CPD questionnaire

Pathogens associated with contamination in Dental Clinics: Evaluating Emerging Threats with a Focus on Mpox

1. **Which of the following answers is CORRECT. What role does saliva play in surface contamination in dental clinics?**
   - A. Saliva has no role in contamination.
   - B. It acts as a reservoir for microorganisms, contributing to microbial dispersion.
   - C. It only spreads viruses, not bacteria or fungi.
   - D. It prevents the spread of bioaerosols in dental environments.

2. **Select the CORRECT answer. Which factor does not influence the production and composition of bioaerosols during dental procedures?**
   - A. Type of dental procedure performed
   - B. Patient's immune status
   - C. The dentist's hand hygiene
   - D. Use of high-speed dental instrumentation

3. **Choose the CORRECT answer. Which of the following statements regarding the survival of pathogens on surfaces in dental settings is true?**
   - A. Mycobacterium tuberculosis can survive on surfaces for only a few hours.
   - B. SARS-CoV-2 is more stable on copper surfaces than on plastic.
   - C. Mpox virus can survive on surfaces for several days to weeks.
   - D. The H1N1 influenza virus cannot survive on stainless steel surfaces.

4. **Select the CORRECT answer. Which of the following measures is most important for selecting an effective disinfectant in dental settings?**
   - A. Its ability to penetrate biofilms
   - B. Its colour and odour
   - C. Its price and availability
   - D. The manufacturer's brand reputation

5. **Which answer is CORRECT. Which of the following pathogens is known to survive on surfaces for up to 72 hours?**
   - A. Candida albicans
   - B. Staphylococcus aureus
   - C. SARS-CoV-2
   - D. Human Immunodeficiency Virus (HIV)

The description of diagnosed cases of Oral Epithelial Dysplasia at the Tygerberg Oral Health Centre

6. **Which statement is INCORRECT. Which of the following statement is false concerning oral potentially malignant disorders (OPMDs)?**
   - A. OPMDs are associated with an increased risk of developing into cancer
   - B. All OPMDs are dysplastic
   - C. Oral leukoplakia, oral submucous fibrosis are lichen planus are some examples of OPMDs
   - D. OPMDs were previously called precancerous lesions.

7. **Which option is INCORRECT. All the following are known risk factors of OSCC except.**
   - A. Areca nut chewing
   - B. Tobacco smoking
   - C. Sugar cane chewing
   - D. Alcohol consumption

8. **Select the CORRECT statement. Which of the following statements is true.**
   - A. Approximately 2.2 - 38.1% diagnosed OED cases will undergo transformation.
   - B. The number of diagnosed cases of cancer and the cancer mortality rate in South Africa is decreasing.
   - C. Cancer cases in South Africa are not of a sufficient number to enter into registries
   - D. All of the above are correct

9. **Which of the following statements is INCORRECT. According to this study:**
   - A. OED cases peak between the 4th and 6th decades.
   - B. There is a negative association between OED and alcohol consumption.
   - C. OED had a female predilection.
   - D. There is significant association between OED and tobacco smoking.

Perspectives on the Minamata Convention and Dental Amalgam Waste Management in South Africa

10. **Select the CORRECT statement. The multilateral environmental agreements with implications for the use of dental amalgam and handling of dental amalgam waste are:**
    - A. The Minamata Convention and the Stockholm Convention
    - B. The Minamata Convention and the Basel Convention
    - C. The Rotterdam Convention and the Minamata Convention
    - D. The Rotterdam and the Stockholm Convention

11. **Select the INCORRECT statement. One of the following is false.**
    - A. Mercury is one of the ten chemicals of public health concern
    - B. Human exposure occurs through consumption of marine life, products and industrial processes
    - C. Human activities have increased environmental mercury levels by 450%
    - D. South Africa is ranked as the 2nd largest emitter of mercury

12. **Select the CORRECT statement. Dental amalgam restorative material.**
    - A. Is the only mercury-added product subject to phased-out in Minamata Convention
    - B. The use in children under 15 years, pregnant and breastfeeding mothers is restricted
    - C. Is not an essential restorative material in South Africa
    - D. Ninety per cent of African countries have phased out the use of dental amalgam

13. **Select the INCORRECT statement. One of the following is false.**
    A. Mercury is a global pollutant that persists in the environment.
    B. Mercury bioaccumulates and biomagnifies in the food chain.
    C. A dietary advisory for fish consumption in South Africa was released in 2015
    D. Artisanal and small-scale gold miners in South Africa do not use mercury

14. **Select the CORRECT answer. In the proposed regulations on the management of mercury in South Africa,**
    A. Dental amalgam can only be sold as a pre-dosed, encapsulated form
    B. Dental facilities must install amalgam separators by the 1st of April 2025
    C. Relevant authorities must develop phase-down plans
    D. All of the above is true

Classification of cases of pre-eruptive intra-coronal resorption

15. **Select the CORRECT option. What percentage of PIR cases were observed in the maxillary teeth?**
    A. 80%
    B. 75%
    C. 70%
    D. 65%
    E. 60%

16. **Which answer is CORRECT. What percentage of cases showed resorption in the dentin or pulp?**
    A. 20%
    B. 45%
    C. 15%
    D. 60%
    E. 95%

17. **Which PIR score was most prominent among the cases?**
    A. Enamel, and dentine 1/3-2/3
    B. Dentine >2/3
    C. Enamel
    D. Enamel and root
    E. Dentine and root >2/3

18. **Select the CORRECT answer. What number of cases of PIR were found in subjects older than 39 years?**
    A. 5
    B. 6
    C. 7
    D. 8
    E. 9

Evidence-based Dentistry:

19. **Select the CORRECT statement. In the Blender et al trial, which statement is the most correct in terms of baseline comparisons of the groups?**
    A. Only the consumption of fresh fruit showed a significant difference between the food intake of the two groups ($p = 0.13$).
    B. Only the consumption of fresh fruit showed a significant difference between the food intake of the two groups ($p = 0.013$).
    C. Only the consumption of fresh fruit showed a significant difference between the food intake of the two groups ($p = 0.33$).
    D. Only the consumption of fresh fruit showed a significant difference between the food intake of the two groups ($p = 0.23$).

20. **In the Blender et al trial, when the issue of the avoidance of certain foods was investigated, which of the following is most CORRECT**
    A. Significant intergroup differences between the two groups at the time of baseline was observed at all time intervals
    B. No significant differences were observed between the two groups at any study times during the first 60 months.
    C. Significant differences were observed between the two groups at only 12 months observation.
    D. Significant differences were observed between the two groups at only 24 months observation

Ethics: Everything you need to know about dental records

21. **Select the CORRECT answer. What is the primary purpose of maintaining accurate dental records?**
    A. To increase practice revenue
    B. To comply with legal requirements
    C. To satisfy curiosity
    D. To impress patients

22. **Which of the following is INCORRECT. Which of the following is NOT considered a component of a dental record?**
    A. Written notes
    B. Radiographs
    C. Prescription eyeglasses
    D. Clinical photographs

23. **Choose the CORRECT answer. What should be included in a good dental record to ensure completeness?**
    A. Personal opinions about the patient
    B. Superfluous personal comments
    C. Detailed clinical findings and treatment plans
    D. Derogatory remarks about the patient

24. **Which answer is CORRECT. How should late or additional entries in a patient's electronic health record be handled?**
    A. They should be deleted immediately
    B. They should be attributed to the correct person without indication of the reason for the change
    C. They should be dated and signed in full, with a specified reason for the amendment
    D. They should be ignored

25. **Choose the CORRECT answer. Who owns dental records created in a private practice?**
    A. The patients
    B. The practice manager
    C. The dentist
    D. The insurance company

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To be kept as brief, clear and unambiguous as possible.

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The abstract shall consist of not more than 200 words.
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Please supply 4-5 Multiple-choice Questions (MCQ's) with 4 or 5 options per question related to your article. Questions must have only one correct answer, and indicate this correct answer clearly.

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Smith NC, Haines A. The role of the dentist in public health promotion. Br Dent J. 1983; 298: 249-51.

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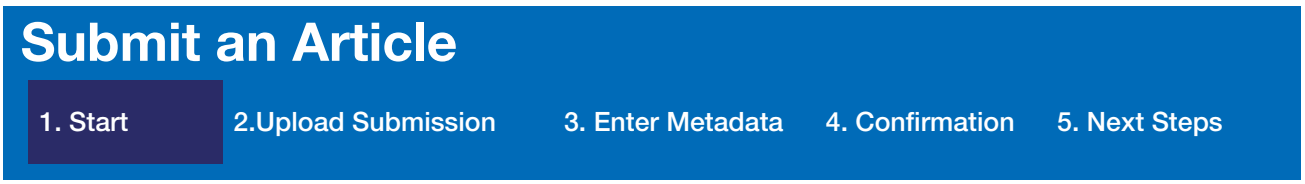

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