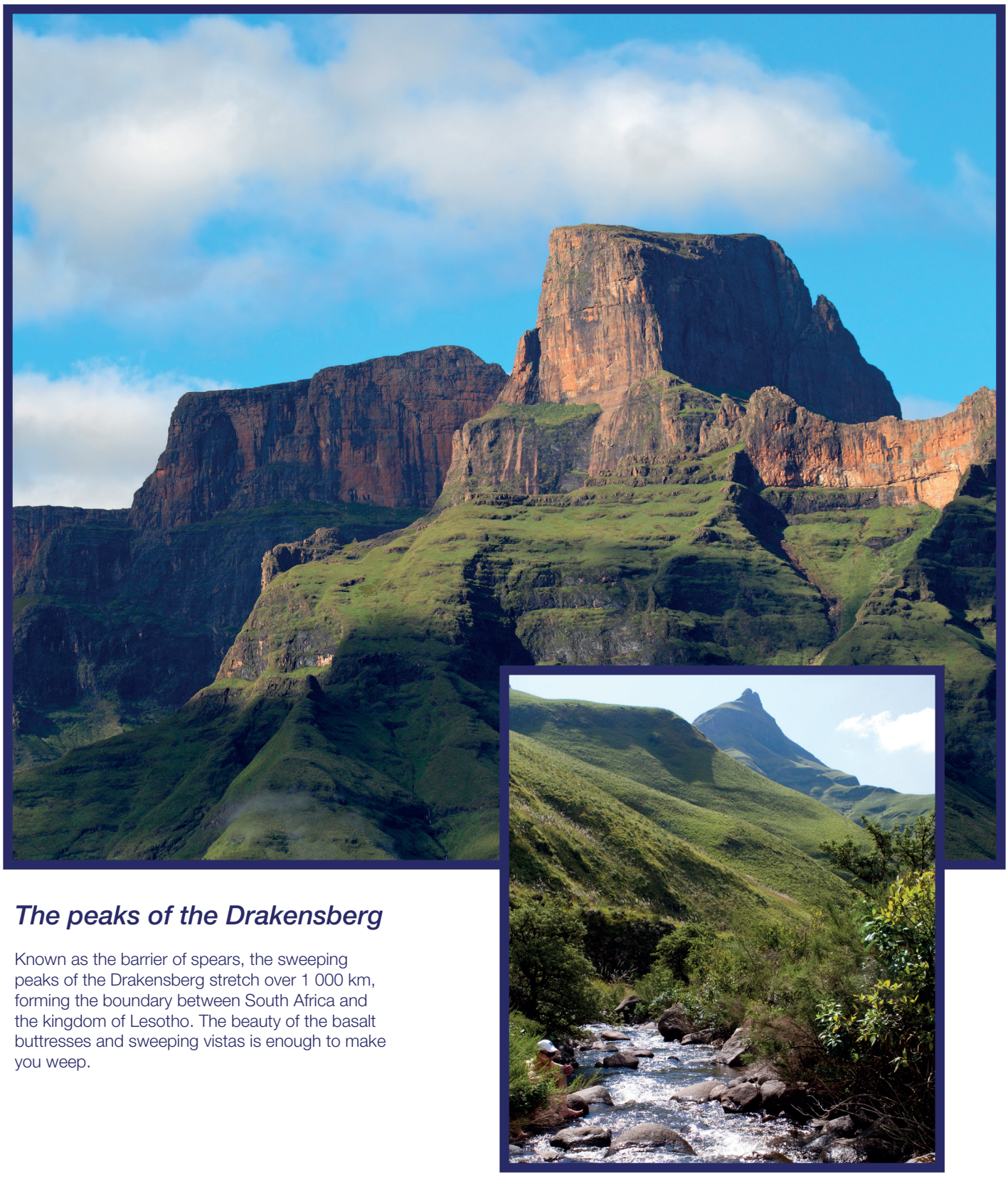
THE SOUTH AFRICAN DENTAL JOURNAL

SADJ

MAY 2023
Volume 78 Number 4

ISSN No. 2519-0105 – Online Edition
ISSN No. 1029-4864 – Print Edition

SADA
THE SOUTH AFRICAN
DENTAL ASSOCIATION



The peaks of the Drakensberg

Known as the barrier of spears, the sweeping peaks of the Drakensberg stretch over 1 000 km, forming the boundary between South Africa and the kingdom of Lesotho. The beauty of the basalt buttresses and sweeping vistas is enough to make you weep.

SADA
THE SOUTH AFRICAN
DENTAL ASSOCIATION

AGM
Annual General Meeting

NOTICE OF AMENDMENT
23rd ANNUAL GENERAL MEETING (AGM) OF
The South African Dental Association NPC ("SADA")

An amended notice is hereby given that the 23rd Annual General Meeting of Members (AGM) of The South African Dental Association (SADA) NPC, will be held on **Thursday 3 August 2023 at 18h00,** which will be conducted virtually on this date through the Zoom virtual meeting platform. **The Agenda together with supporting documents for the meeting will be sent electronically to members and posted on the SADA website.**

Members are advised that they must have access to a computer or smart device or dial-up facility in order to join the online meeting. In view of extraordinary circumstances and to ensure maximum participation of voting members on resolutions tabled at an AGM, we call for the early return of proxies from members who are unable to attend.

Questions from members: We are encouraging members to raise questions prior to the AGM, thereby allowing those not in attendance, the opportunity to raise issues that can then be dealt with at the AGM or referred to the National Council meeting. This will also assist with the present electricity load-shedding schedules which prevent members from attending. The questions and answers covered in the AGM will, following the meeting, be published on the Association's website.

SADA is *your* Association and *your* voice counts.

KC Makhubele
Chief Executive Officer
May 2023

THE SOUTH AFRICAN DENTAL JOURNAL

SADJ

Published by: CREATIVE SPACE MEDIA

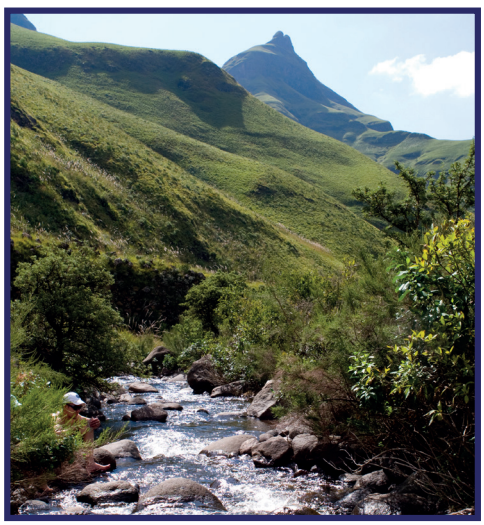
On behalf of: SADA THE SOUTH AFRICAN DENTAL ASSOCIATION

CONTENTS

Our Front Cover for this Issue...

The peaks of the Drakensberg

Known as the barrier of spears, the sweeping peaks of the Drakensberg stretch over 1 000 km, forming the boundary between South Africa and the kingdom of Lesotho. The beauty of the basalt buttresses and sweeping vistas is enough to make you weep.



THE SOUTH AFRICAN DENTAL JOURNAL
SADJ

PRODUCTION OFFICE
Creative Space Media
Tel: +27 (11) 467 3341
Website: www.creativespacemedia.co.za

Publisher and Project manager
Yolandi Badenhorst – yolandi@creativespacemedia.co.za
Leani Thomson – leani@creativespacemedia.co.za

GENERAL AND ADVERTISING ENQUIRIES
James Chademana
Email: james@creativespacemedia.co.za
Tel: +27 (11) 467 3341

Design and Layout
Leani Thomson
Email: leani@creativespacemedia.co.za

Website smalls advertising / CPD Enquiries and Member contact detail update
South African Dental Association
Tel: +27 (0)11 484 5288
Email: marketing@sada.co.za

Published by: CREATIVE SPACE MEDIA

On behalf of: SADA THE SOUTH AFRICAN DENTAL ASSOCIATION

CONTENTS

Accredited by the Department of Education SADJ is published 10 times a year by E-Doc, a Division of Pharmcom CC, on behalf of The South African Dental Association.

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.16407

Dentists have an obligation to expand their knowlodge and to contribute to knowledge

SADJ May 2023, Vol. 78 No.4 p1

Prof NH Wood - *BChD, DipOdont(MFP), MDent(OMP), FCD(SA), PhD*

Dentistry is shaped by dental research, which also drives innovation and improves oral health outcomes. As dental scientists are at the forefront of knowledge, it is important to understand their role in pushing the boundaries of research. Dentistry as a whole must promote the value of developing and funding dental research in South Africa; and draw attention to the urgent need to pay more attention to translational research. We should also emphasize the academic obligations of dental schools and faculty to advance knowledge and contribute to the literature in parallel to the provision of much needed dental services to the people of South Africa.

Dentists have an obligation to expand their knowledge, but also to contribute to knowledge, no matter how small that contribution may be. Academics in the field of dentistry play a key role in pushing the boundaries of knowledge. Their dedication and knowledge enable groundbreaking discoveries and breakthrough technologies to provide the best service and care to patients and communities. Academic staff have an important duty to create an environment conducive to research and academic endeavors and to pass on knowledge to future generations of dentists through integration into teaching and training. Dental research has grown significantly in recent years in South Africa, with great success and breakthroughs. The dedication of dental institutions and researchers to pioneering the frontiers of knowledge is commendable. However, it is important to recognize that there is still a lot of room for growth. Ongoing institutional and financial support is required for dental research in South Africa to continue to progress and reach its full potential. This empowers new and developing dental academics to contribute their voices to the growing knowledge pool in dentistry.

In the South African dentistry scene, translational research, the link between scientific advancements and their implementation in clinical practice, has enormous promise. We can translate scientific discoveries into practical advantages for patients and communities by embracing translational research. Prioritizing and promoting partnerships that make it easier to translate research findings into better oral health outcomes for our population is crucial. In the pursuit of translational research, areas like preventative dentistry, inequities in oral health, and novel treatment methods demand special consideration.

Dentists have academic obligations beyond clinical practice and classroom instruction. This includes actively participating in research, publishing results, and disseminating information to the wider dental community. Scholars who

publish papers in dental literature not only extend known knowledge, but also encourage other researchers to pursue new directions of research and ingenuity.

Academic teachers can contribute to literature in many ways. Publication of research results in prominent publications facilitates discussion and information sharing among colleagues, and is the primary mode of dissemination of new knowledge. Writing a literature review or critical analysis also helps synthesize current data, identify knowledge gaps, and guide further research. Sharing clinical insights and best practices through case studies and clinical guidelines has a profound impact on dental practice and patient care.

But individual efforts alone are not enough. Cooperation and knowledge sharing between the dental school and academic staff are essential to fostering a vibrant research culture. Importantly, this includes much needed support from government. By building research networks and participating in interdisciplinary collaborations, we are able to combine resources, knowledge and perspectives to address complex oral health issues in South Africa. Furthermore, mentorship programs can be crucial in training the next generation of dental researchers and ensuring a continuous stream of progress and innovation.

The dedication and contributions of dental scientists drive progress in dental research in South Africa. But we must understand that it is our duty to promote and facilitate its growth. By focusing on translational research and enhancing academic contributions to literature, we will be able to bridge the gap between research and clinical practice. This will inevitably improve the oral health of our citizens.

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.16405

Smile brighter: unleashing the power of dental marketing strategies

SADJ May 2023, Vol. 78 No.4 p176-177

Mr KC Makhubele – CEO, South African Dental Association

As the CEO of our prestigious organisation, I would like to discuss a matter that concerns me. As a former marketing specialist, I have observed that many of our members are not maximising the effectiveness of their marketing strategy. To this end, I have created a list of marketing methods that members might use to boost their efforts. This list is not exhaustive, but I hope it will provide our members with great insights and actionable advice that will help them thrive in their marketing initiatives.

Let's investigate these tactics together and uncover the maximum marketing potential for the success of our members. We can elevate our association to new heights if we work together! So, let's examine 16 effective marketing methods that can revolutionise your dental practice. It's time to begin this road to higher marketing success.

1. Pay-per-click (PPC) advertising should be utilised. Consider using targeted PPC campaigns, such as Google AdWords, to target specific keywords and demographics and increase website traffic. Establish a budget in line with your marketing objectives and regularly evaluate and improve your PPC ads to maximise your return on investment.
2. Build original, keyword-optimised content for your website and blog. Generate original, keyword-optimised content for your website and blog to deliver relevant information to your patients and promote yourself as an industry thought leader. Promote your content using social media within the ethical guidelines and email campaigns to engage your audience (patients who have consented to their receipt) and increase website traffic.
3. Provide unique promotions and incentives. Offer unique promotions and incentives, such as teeth whitening or free consultations for new customers, to encourage prospective patients to choose your dental clinic over the competition. To generate buzz and attract new patients, publicise these deals on your website and social media pages, and via email campaigns to your patients.
4. Use social media marketing. Use social media channels such as Facebook, Instagram and LinkedIn to communicate with your audience and connect with your local community. Provide compelling information, such as informative films, and connect with your followers to establish rapport and brand loyalty.
5. Establish online reservations and telehealth. Provide online scheduling and telehealth services to provide patients with flexibility and convenience. Let people schedule appointments, fill out forms and engage in virtual consultations online. To attract tech-savvy patients who prefer digital solutions, promote these services on your website and through email marketing.
6. Engage in neighbourhood activities and sponsorships. To boost your visibility and brand recognition in the community, participate in local events such as health fairs.
7. Employ online reputation management. Control your online reputation by monitoring and replying to reviews on Google, Yelp and social media networks. Reply professionally and immediately to both positive and negative evaluations, and use feedback to enhance your services. To construct a positive online reputation, encourage satisfied patients to provide reviews and testimonials.
8. Establish rapport with referral partners. Create partnerships with area physicians, paediatricians, orthodontists and other healthcare providers who can send patients to your dental office. Supply them with educational materials and conduct collaborative promotions and build a referral programme to produce a consistent stream of new patients through referral incentives.
9. Implement chatbots and artificial intelligence. Use chatbots and other AI-powered technology on your website and social media platforms to give immediate customer service, answer commonly asked questions and arrange appointments. This can enhance the patient experience and expedite communication, resulting in higher patient loyalty and satisfaction.
10. Provide programmes for patient education. To educate your patients on dental health, preventive care and treatment options, provide patient education programmes such as seminars, workshops and webinars. Provide informative content on your website and through social media and email campaigns to your patients, and encourage patients to join in your initiatives to cultivate trust and brand loyalty.
11. Employ video marketing. Produce and distribute informative and interesting films on your website to educate patients about dental procedures, and highlight your dental office. Videos can be an effective medium for showcasing your dental business and engaging your audience. Make informative and artistically appealing videos that showcase your services, introduce your team and give oral health education. Share these films on your website to boost your online presence and attract potential patients.
12. Using live chat on your website can significantly enhance the patient experience and boost conversions. Patients can quickly submit inquiries, make appointments and receive prompt support from your staff. Ensure that skilled personnel are accessible to answer swiftly live chat enquiries and to deliver outstanding customer support.
13. Benefit from influencer marketing Collaboration with influencers in your local community or dentistry specialisation will help you reach a larger audience and establish a reputation. Find influential individuals

https://doi.org/10.17159/sadj.v78i04.16405

whose beliefs fit with those of your business and who have a substantial following. This can help you tap into their audience and increase your practice's visibility.

14. Provide exclusive promotions and incentives. Develop unique incentives and promotions to attract new patients and encourage return visits. Provide discounts on particular services to generate a sense of urgency and inspire patients to take action; promote these promos via your website, social media and email campaigns to your patients.
15. Provide telehealth services. Include telehealth services in your practice to accommodate patients who prefer virtual consultations or have limited mobility. For specific dental services, provide virtual consultations, online appointment scheduling and virtual follow-ups. To attract patients who value the ease and adaptability of virtual care, promote these telehealth services on your website and through your marketing channels.
16. Deliver a great patient experience. The total patient experience at your dental clinic is essential for referrals from satisfied patients and repeat business. Concentrate on offering great customer service, establishing a friendly and comfortable atmosphere and leveraging current technologies to expedite patient encounters. Teach your team to be personable, competent and sensitive to patient demands, and continually monitor and enhance the patient experience to surpass their expectations.

In conclusion, marketing dental practices in 2023 will necessitate a smart and multifaceted approach that blends digital marketing methods, community participation and exceptional patient experience. You can effectively market your dental practice and attract new patients in 2023 and beyond by using various marketing strategies, optimising your online presence, showcasing patient testimonials, utilising social media, offering special promotions, hosting community events, providing telehealth services and prioritising patient experience. Remember to analyse and adjust your marketing efforts regularly to accommodate shifting patient needs and market trends. To ensure the long-term success of your dental office, you must always place a premium on giving value to your patients and establishing trust and credibility in your local community.

Good luck!


SADA
DENTAL & ORAL HEALTH
CONGRESS AND EXHIBITION
25–27 AUGUST 2023 | CTICC, Cape Town
JOIN US IN CAPE TOWN
VISIT
WWW.SADACONGRESS.CO.ZA
OR CALL +27 11 484 5288
FOR MORE INFORMATION AND
ASSISTANCE TO REGISTER
THE SOUTH AFRICAN DENTAL ASSOCIATION
PRIVATE BAG 1, HOUGHTON, 2041, JOHANNESBURG, SOUTH AFRICA
T: +27 11 484 5288 E: INFO@SADA.CO.ZA WWW.SADA.CO.ZA

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.16408

Dear Editor

SADJ May 2023, Vol. 78 No.4 p179

RD Maart

Dental schools across the world aim to prepare and train dental graduates to be competent and fit to practice independently. However, educators seem to differ in their objectives and ideals.

Globally, official documents on competencies for the new dental graduates were published – The American Dental Education Association (ADEA) approved competencies;[1] the Canadian dental programmes adopted a national consensus for competencies in 1994;[2] the General Assembly of the Association for Dental Education in Europe approved competencies for the European Dentist;[3] and the Dental Council of New Zealand in 2012.[4]

For South Africa, the African Medical Education Directions for Specialists (AfriMEDS) core competency framework was adapted from the Canadian Medical Educational Directives for Specialists (CanMEDS) by the Health Professions Council of South Africa.[5] The reason for the adoption and supplementary modification was to align the framework with the South African context and to be sufficiently generic to guide the training of all health professionals. Seven roles are included in AfriMEDS core competency framework (Health Care Practitioner, Communicator, Collaborator, Leader and Manager, Health Advocate, Scholar and Professional).[5] As CanMEDS framework was initially developed for specialist training, the feasibility of "translation" of the core competencies for dental graduates requires deeper interrogation.

Reviewing the AfriMEDS roles requires innovative processes that should include stakeholders such as the regulatory body, academia, private and public sectors. It is unclear whether access to oral health care and oral health disease burden were considered when the seven roles were developed. Given that oral health is not set as a health priority in South Africa contributes to the complexity of the development and adoption of the AfriMEDS core competency framework for dental schools.

When reviewing these seven roles consideration should be given to the other local and international factors that impact the training of healthcare professionals in South Africa, including dentists. The local factors include the National Development Plan 2030;[6] the inequity in the burden of disease;[7-9] and the call by the National Department of Higher Education and Training for the decolonisation of curriculum in higher education.[10] A major international factor is the recommendation of the Commission on Education of Health Professionals for the 21st Century.[11]

Giving due consideration to these local and international factors in the development of the competencies in undergraduate dental education in South Africa will be beneficial in raising the standard of oral health care in the country. For example, the call for decolonisation of curriculum acknowledges the inherent power relations in the production and dissemination of knowledge, and seeks to destabilise these, allowing new forms of knowledge which represent marginalised groups.[12-13]Deconstructing the role of the oral health professional may bring a new perspective relative to our local context. In addition to these factors, COVID-19 and digital dentistry have impacted dental education and practice globally. For example, Ali *et al*[14] reported that, compared to the educators, dental students considered online learning to be less interactive and preferred learning activities and all assessments to be delivered face to face. This underscores the need to adapt teaching practices to suit the learning needs of the students.

Similarly, Tukuru *et al*[15] reported that in South Africa, dental students' training is largely centred around clinical practice, despite evidence showing the students believe that leadership skills are imperative in their education. Could this be an opportune time to reconsider the competencies required for dental graduates in South Africa in the 21st century?

Author information
RD Maart (*BChD*, *MPhil*, *PhD*) Faculty of Dentistry, University of the Western Cape
ORCID: https://orcid.org/0000-0002-1560-040X

Corresponding author
Name: Ronel Maart
Tel: +27 21 9373181
Email: rmaart@uwc.ac.za

REFERENCES

1. Ditmyer M, Mobley C, Davenport W. Evaluation of an integrative model for professional development and research. JDE. 2014;78:368–79. doi: 10.1002/j.0022
2. Gerrow J, Murphy J, Boyd M. Review and revision of the competencies for a beginning dental practitioner in Canada. JCDA. 2007;73(2):157–60
3. Cowpe J, Plasschaert A, Harzer W, Vinkka-Puhakka H, Walmsley A. Profile and competences for the graduating European dentist – update 2009. Eur J Dent Educ. 2010;14:193–202. https://doi.org/10.1111/j.1600-0579.2009.00609.x 0337.2014.78.3.tb05687.x
4. Dental Council of New Zealand (DCNZ). Competency standards and performance measures for dental therapists. DCNZ, Wellington, New Zealand (2012) Available at: http://www.dentalcouncil.org.nz/Documents/Policy/TherapistsCompetencyStandardsMeasures.pdf. [accessed 03/05/23]
5. Van Heerden B. Effectively addressing the health needs of South Africa's population: The role of health professions education in the 21st century. S. Afr Med J. 2013;103:21–2. https://doi.org/10.7196/SAMJ.6463National Planning Commission. National Development Plan: Vision for 2030. Pretoria, South Africa (2011): The Presidency of the Republic of South Africa
6. Mayosi, B.M., Flisher, A.J., Lalloo, U.G., Sitas, F., Tollman, S.M., & Bradshaw, D. (2009). The burden of non-communicable diseases in South Africa. The Lancet, 374(9693), 934-947Achoki, T., Sartorius, B., Watkins, D., Glenn, S.D., Kengne, A.P., Oni, T., ... & Naghavi, M. (2022). Health trends, inequalities, and opportunities in South Africa's provinces, 1990–2019: findings from the Global Burden of Disease 2019 Study. J Epidemiol Community Health, 76(5), 471-481Brady, E., Castelli, M., Walker, R., Grayling, M., Alaba, O., & Chola, L. (2022). The prevalence and social determinants of multimorbidity in South Africa. World Medical & Health PolicyZawada B. Invisible statues of colonisation: Regulatory curriculum requirements in South African higher education. Africa Education Review. 2020 May 1;17(3):142-57
7. Bhutta, Z.A., Chen, L., Cohen, J., Crisp, N., Evans, T., Fineberg, H., ... & Zurayk, H. (2010). Education of health professionals for the 21st century: a global independent Commission. The Lancet, 375(9721), 1137-1138Begum N, Saini R. Decolonising the curriculum. Political Stud. Rev. 2019;17:196-201. https://doi.org/10.1177/1478929918808459
8. Du Plessis, P. (2021). Decolonisation of education in South Africa: Challenges to decolonise the university curriculum. South African Journal of Higher Education, 35(1), 54-69Ali, K., Alhaija, E.S.A., Raja, M., Zahra, D., Brookes, Z.L., McColl, E., ... & Daher, H.O. (2023). Blended learning in undergraduate dental education: a global pilot study. Medical Education Online, 28(1), 2171700Tukuru, M.O., Snyman, L., Postma, TC., & van der Berg-Cloete, S.E. (2021). Dentistry in South Africa and the need for management and leadership training. South African Dental Journal, 76(9), 532-536

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.15434

Effect of separated instruments on periapical pH using calcium hydroxide as an intracanal medicament in curved root canals

SADJ May 2023, Vol. 78 No.4 p180-183

R Sungur Güzel[1], BC Çanakçi[2], Ö Er, E Arılı Öztürk[3]

ABSTRACT

Objective

To evaluate the effect of intracanal separated instruments with different lengths on periapical pH levels using calcium hydroxide (CH) as an intracanal medicament in curved root canals.

Materials and methods

120 teeth (root canal curvature >25°) were divided into six groups following the root canal preparation. In Group 1, 2mm and in Group 2, 4mm NiTi instruments were separated in the apical portion of the root canals and CH paste was applied. In Groups 3 and 4, no separated instrument but CH was applied. In Groups 5 and 6, neither a separated instrument nor CH was applied. The samples were placed inside a glass tube with distilled water. pH of this distilled water was measured at different time points.

Results: At all time points, pH values between the experimental groups were similar except at 1-day (Group 1 < Group 2, $P<0.05$). At the 2-day and 30-day time points, Group 3 showed higher pH values than Group 1 ($P<0.05$). At 7-day and 14-day points, pH values were similar.

Conclusion

The presence of a separated instrument with different lengths in curved root canals did not have a significant effect on the pH increase caused by CH used as an intracanal medicament.

Authors' information

1. Rezan Sungur Güzel. Assistant Professor, Okan University, Faculty of Dentistry, Department of Endodontics, Istanbul, Turkey. ORCID: 0000-0003-4940-3786
2. Burhan Can Çanakçi, PhD. Associate Professor, Trakya University, Faculty of Dentistry, Department of Endodontics, Edirne, Turkey. ORCID: 0000-0001-8872-5513
3. Özgür Er, PhD. Professor, Trakya University, Faculty of Dentistry, Department of Endodontics, Edirne, Turkey. ORCID: 0000-0002-4999-5104
4. Esra Arili Öztürk. Research assistant, Trakya University, Faculty of Dentistry, Department of Endodontics, Edirne, Turkey. ORCID: 0000-0003-2137-4442

Corresponding author

Name: BC Çanakçi
Tel: +90 505 8829070
Email: burhancanakci@trakya.edu.tr

Author's contribution

1. R Sungur Güzel 35%
2. BC Çanakçi 35%
3. Ö Er 15%
4. E Arili Öztürk 15%

INTRODUCTION

Separation of endodontic files can occur,[1] particularly in the narrow and/or curved root canals[2] and in the apical third of the root canal.[3] When using rotary nickel-titanium (NiTi) instruments, which have been reported to be more resistant to deformation and separation and flexible than stainless-steel files (4), the incidence of instrument separation ranges from 0.4%–5%.[5] Regardless of the experience of the clinicians and the number of usage of the files, instruments can be separated without any visual warning signs.[6]

Removal of a separated instrument, particularly in the apical third of the root canal, can be challenging and has a lower success rate compared to traditional root canal treatment without file separation.[2] In curved root canals, the success rate in instrument retrieval is high for the separated instruments before the canal curvature, medium for those located in the curvature, and low for those located beyond the curvature.[4,7,8] Additionally, various complications, such as temperature increase on the external surface of the root, ledge formation, root canal transportation, decrease in root strength and perforations may occur during the removal process.[9] If a separated instrument cannot be removed, bypassing the separated instrument, shaping and obturating the coronal portion of the root canals, or performing retrograde endodontic surgery are the possible options.[1]

The separated instrument may prevent chemomechanical disinfection or obturation of the root canal and compromise the achievement of treatment goals, thereby affecting the prognosis of orthograde treatment,[1] especially if the apical part and/or the root canal area harboring the instrument fragment is not cleaned sufficiently.[10] In addition, the preoperative diagnosis of the pulp, especially the presence of periapical pathology, may adversely affect the treatment results.[1,10,11]

Calcium hydroxide (CH) is a widely used intracanal medicament. The effect of the CH depends on the alkaline pH caused by its rapid decomposition into hydroxyl (OH^-) and calcium ions (Ca^{+2}).[12] With a pH of around 12.5, CH can neutralise many microorganisms commonly found in infected root canals after short-term direct contact.[13] The alkalising effect of CH occurs by diffusion of OH^- ions through the apical foramen, ramifications, accessory canals and dentinal tubules.[12] Various factors such as the buffering effect of dentin,[14] the thickness of root canal dentin[15] and limited solubility may affect the pH level caused by CH and prevent CH from producing its expected biological effects.

https://doi.org/10.17159/sadj.v78i04.15434

The relationship between separated instruments and the periapical pH value caused by the application of CH as an intracanal dressing in straight root canals was previously evaluated by AUTHOR *et al*.[16] This study aimed to evaluate the effect of the presence of separated instruments with different lengths on periapical pH levels using CH as an intracanal medicament in curved root canals. The null hypothesis was that the presence of a separated instrument does not affect the apical pH level when CH is used in curved root canals.

MATERIALS AND METHODS

This study was approved by the Ethics Committee of AUTHOR University, Medical Sciences (Decision no: 2017/130). Based on the target statistical power of 95%, when the type 1 error was determined as 0.05 ($\alpha = 0.05$) and the type 2 error was determined as 0.20 ($\beta = 0.20$), the number of teeth required for each group was determined as 20.

A total of 120 freshly extracted human mandibular and maxillary incisor teeth were used. Radiographs were taken from the buccal and proximal directions to confirm the root canal anatomy (Vertucci - Class I) (17), mature apex, no resorption, no root canal calcification, no previous root canal treatment and root canal curvature of >25°.[18] The teeth with a width of 2-2.5mm in bucco-lingual and mesio-distal directions at 2mm far from the root tip were used.

The teeth were kept in a 5% sodium hypochlorite (NaOCl) solution (Werax, SDD, İzmir, Turkey) for 1h, then the periodontal soft tissue residues and calculi were removed and washed under distilled water. All teeth were shortened to 14mm with a low speed 0.3mm thick diamond separator (930 D, Meisinger, Neuss, Germany) by flattening the incisal edge. A coronal access cavity was opened using a diamond bur (Diatech; Coltene Whaledent, Altststten, Switzerland) and a high-speed handpiece.

A size of 10-K file (VDW, Munich, Germany) was inserted into the root canal until the tip of the file was visible at the major apical foramen and the working length (WL) was determined as 1mm subtracting from this measurement under an operating microscope (Opmi Pico; Carl Zeiss, Oberkochen, Germany). If the 10-K file did not squeeze in the apical third part of root canal, the sample was renewed. Teeth were coated with two layers of nail polish, except for the apical tip of 3mm.

The samples were randomly divided into six groups ($n = 20$).

Group 1: Teeth were prepared with the Revo-S NiTi (Micro-Mega, Besancon, France) system using SC1 (#25, 0.06; Micro-Mega) in the coronal portion of the root canal and SC2 (#25, 0.04; Micro-Mega) to the WL, with rotating motion according to the manufacturer's recommendations. Apical patency was controlled with a 10-K file.

Next, unused Revo-S SC2 files were weakened 2mm from the tip using a low-speed diamond separator and washed in an ultrasonic bath to avoid debris. The instruments were mounted into a handpiece and placed into the root canals to the WL, and then the handpiece was activated. The instruments were separated at the weakened point by the rotating movement. The level and length of the separated instrument in the root canals were confirmed with radiographs. If the separated instrument was below or above the WL, the sample was replaced. The coronal part of the root canal above the separated instrument was manually prepared to #50 up to #70 using the step-back technique.

During the instrumentation, 5% NaOCl was used for irrigation. The final irrigation was performed with 5ml of 17% EDTA (Cerkamed Company, Stalowa Wola, Poland), 5ml of 5% NaOCl and 10ml of distilled water, respectively. Then, the root canals were dried with paper points (DiaPro, Diadent Group Int, Chungcheongbuk-do, Korea).

A CH paste mixed with propylene glycol (Merck, Darmstandt, Germany) with a ratio of 1g powder to 0.4ml liquid was placed into the root canals using a #25 Lentulo spiral filler (Paste carriers, Dimsan Dental, Ankara, Turkey) located 6mm deep to the coronal tip. The intracanal dressing was confirmed with radiographs. The access cavities were sealed with composite resin (EsFlow, Spident, Kore) and the crowns were sealed with two layers of nail polish.

The teeth were placed in glass test tubes containing 3.5ml of deionised distilled water. The tubes were stored in an incubator at 37°C with 100% humidity. After 1h and 1, 2, 7, 14, and 30 days, the pH of the solution in the tubes

Table I. Means and standard deviations of pH values for groups at different time points.

	Group 1 (2mm)	Group 2 (4mm)	Group 3 (Positive Control of Group 1)	Group 4 (Positive Control of Group 2)	Group 5 (Negative Control of Group 1)	Group 6 (Negative Control of Group 1)
1-hour	9,44 (9,21-9,9)^{A}	9,94 (9,5–10,2)^{A}	10,04 (9,6–0,3)^{A}	9,7 (9,51-10,03)^{A}	6,65 (6,59–6,75)^{B}	6,6 (6,5–6,7)^{B}
1-day	8,10±0,83^{A}	8,79±1,14^{B}	8,35±0,77^{AB}	7,94±0,68^{A}	7,2±0,12^{C}	7,11±0,10^{C}
2-day	6,96 (6,8–7,52)^{A}	7,01 (6,93–8,18)^{AB}	7,21 (7-7,67)^{B}	7,09 (7–7,4)^{AB}	7,06 (7,01–7,15)^{AB}	6,97 (6,89–7,04)^{AC}
7-day	7,9 (7,75–8,3)^{A}	7,88 (7,7–8,3)^{A}	8,27 (7,93–8,33)^{AB}	7,82 (7,55–8,02)^{AC}	7,78 (7,63–7,9)^{AC}	7,61 (7,5–7,7)^{D}
14-day	7,92 (7,7–8,39)^{A}	7,92 (7,73–8,11)^{A}	8,1 (7,84–8,56)^{A}	7,85 (7,73–8,35)^{A}	7,85 (7,5–8,5)^{A}	7,86 (7,64-8,45)^{A}
30-day	7,7 (7,56–8,31)^{A}	7,8 (7,6–8,54)^{ABC}	8,29 (7,73–8,63)^{B}	7,82 (7,7–7,95)^{AB}	7,67 (7,42–8,41)^{A}	7,57 (7,48–8,26)^{AC}

Different letters indicate statistical difference [$P<0.05$ for all time points; except 1 hour ($P<0.001$)].
Descriptive statistics values; Median (25-75) on the 1h, 1 and 7, 14 and 30-day time points; mean-standard deviation at 1-day time point.

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.15434

was measured using a pH meter (Hanna 83141; Hanna Instruments, Woonsocket, RI, USA) that was calibrated before each measurement with the known pH (4, 7 and 10) of the solutions. After every measurement, the teeth were placed in new tubes containing fresh deionised distilled water with a pH of 6.9.

Group 2: Same procedure as in Group 1, but the length of the separated instruments was set to 4mm.

Group 3 (Positive Control Group of Group 1): Same procedure as in Group 1 but without a separated instrument in the root canal.

Group 4 (Positive Control Group of Group 2): Same procedure as in Group 2 but without a separated instrument in the root canal.

Group 5 (Negative Control Group of Group 1): Same procedure as in Group 3 but without placement of CH paste.

Group 6 (Negative Control Group of Group 2): Same procedure as in Group 4 but without placement of CH paste.

Statistical analysis

Statistical analysis was performed using SPSS software (ver 20.0; SPSS Inc, Chicago, IL, USA). The normality of the distributions was confirmed by the Kolmogorov-Smirnov test. One-way ANOVA was used for the inter-group and between the groups' comparisons with the normal distribution, and the Kruskal-Wallis test for the groups with non-normal distribution. After the Kruskal-Wallis analysis of variance, Bonferroni correction was used for pairwise comparisons (P<0.05).

RESULTS

Table 1 shows the means and standard deviations of pH values for groups at different time points. At the 1h and 1-day time point, the experimental and the positive control groups showed significantly higher pH values than the negative control groups (P<0.05). At all time points, pH values between the experimental groups were similar (P>0.05) except at the 1-day time point [Group 1 (2mm) < Group 2 (4mm) P<0.05]. At the 1-day time point, Group 1 (2mm) and Group 4 (positive control of 4mm) showed significantly lower pH values than Group 2 (4mm; P<0.05). At the 2-day and 30-day time points, Group 3 (positive control of 2mm) showed significantly higher pH values than Group 1 (2mm; P<0.05).

DISCUSSION

The presence of a separated instrument in the canal during root canal treatment may have a negative effect on the outcomes of the treatment, depending on the location of the fracture, chemo-mechanical preparation stage and the periapical status.[1,10,11] However, there is no consensus yet on which treatment procedure should be performed in cases where the separated instrument cannot be removed. In this study, the alkalising effect of CH as an intracanal medication on periapical tissues was evaluated in the presence of separated instruments of two different lengths in the apical third of curved root canals. According to the results of this study, the alkalising effect of CH was not affected by the presence of separated instruments.

According to the results of this study, the highest pH values of the experimental and control groups were observed at 1h and 1-day time points (P > 0.05), similar to the results of AUTHOR *et al*[16] (and AUTHOR *et al*).[19] This may be due to direct contact of the medication through the apical foramen and the sudden release of the OH^-.[20] Also, the pH values decreased with time and the lowest values were detected at the 30-day time point. Similarly, AUTHOR *et al*[21] reported a decrease in the pH values toward 30 days. However, AUTHOR *et al* (16) and AUTHOR *et al*[22] reported an increase in pH over time. The buffering effect of dentin that can inactivate the alkalinising effect of CH[23] can explain the results of this study. The alkalising effect of CH is associated not only with time but also with the amount of CH paste in the root canal.[24] The dilution of CH paste over time may be another reason.

Based on the results, the effect of the presence of a separated instrument on pH levels was not significant at all time points compared to the control groups. Group 3 (Positive control of 2mm group) showed higher pH values than Group 1 (2mm) at all time points, but the difference was significant only at 1- and 30-day time points ($P < 0.05$). Similarly, at 2- and 4-day time points, Group 4 (Positive control of 4mm group) showed higher pH values than Group 2 (4mm; $P > 0.05$), while Group 2 (4mm) showed higher values at other time points ($P > 0.05$). These results are contrary to the results of AUTHOR *et al*[16] who reported that the presence of separated instruments had a significant effect compared with the control groups. The main method for CH to act is that the material diffuses through the apical foramen, which may be hindered by a separated instrument. The inconsistent results between studies can be explained by differences in method, such as the use of roots with different curvatures, differences in mechanical shaping, root dentin of different thicknesses resulting from the different shaping procedures, and the possibility that the separated instrument may produce a more inadequate physical plug-in curved root canals than in straight root canals. Also, a 2mm instrument may cause physical obstruction/compression of more than 4mm.

According to the results of this study, when the experimental groups with different lengths of separated instruments were compared, the effects on pH were similar at all time points except the 1-day time point [Group 1 (2mm) < Group 3 (4mm; $P < 0.05$)]. However, AUTHOR *et al*[16] reported significantly lower pH values in the presence of a 4mm separated instrument than 2mm. This difference may be due to the abovementioned reasons.

Several precautions were taken to standardise the samples. The diffusion of OH ions may be affected by the thickness of dentin and cementum, the volume of root canal at apical third, shape and structure of the apical foramen, the presence and number of lateral canals and ramifications;[22] the amount and size of dentinal tubules in the apical third,[23] and dentin buffering effect capacity. Moreover, the standardisation of the root canal curvature is important since the instrument that was separated was close to the maximum canal curvature position due to torsional fatigue.[25] Since the Schneider Method is based on the angle of curvature alone, it provides limited information compared to techniques that suggest using multifactorial measurement with three-dimensional (3D) imaging.[26] Also, the contact area between the separated instrument and the inner root canal dentin may affect the penetration of intracanal dressing. Another limitation of the study is that different NiTi files produced

https://doi.org/10.17159/sadj.v78i04.15434

from metals that have gone through different production stages and treatments may affect the pH provided by CaOH and should be investigated in further studies.

CONCLUSION

Within the limitations of this study, the presence of a separated instrument in curved root canals did not have a significant effect on the pH increase caused by CH used as an intracanal medicament. Also, the effect of separated instruments of different lengths is similar. Additionally, in the presence of a separated instrument, to keep the alkalising effect of the CH paste high, it may be recommended to replace the medication every 24h. Further microbiological and clinical studies are needed to investigate the impact of a separated instrument in curved root canals using different types of medications.

Conflict of interest

None declared.

Funding

Supported by AUTHOR University Scientific Research Projects Unit with TDK (project number 2017/172).

REFERENCES

1. Panitvisai P, Parunnit P, Sathorn C, *et al*. Impact of a retained instrument on treatment outcome: a systematic review and meta-analysis. J Endod 2010;36:775-780
2. Suter B, Lussi A, Sequeira P. Probability of removing fractured instruments from root canals. Int Endod J 2005;38:112-123
3. Parashos P, Messer H. Questionnaire survey on the use of rotary nickel-titanium endodontic instruments by Australian dentists. Int Endod J 2004;37:249-259
4. Iqbal MK, Kohli MR, Kim JS. A retrospective clinical study of incidence of root canal instrument separation in an endodontics graduate program: a PennEndo database study. J Endod 2006;32:1048-1052
5. Tzanetakis GN, Kontakiotis EG, Maurikou DV, *et al*. Prevalence and management of instrument fracture in the postgraduate endodontic program at the Dental School of Athens: a five-year retrospective clinical study. J Endod 2008;34:675-678
6. Ankrum MT, Hartwell GR, Truitt JE. K3 Endo, ProTaper, and ProFile systems: breakage and distortion in severely curved roots of molars. J Endod 2004;30:234-237
7. Ward JR, Parashos P, Messer HH. Evaluation of an ultrasonic technique to remove fractured rotary nickel-titanium endodontic instruments from root canals: an experimental study. J Endod 2003;29:756-763
8. Lopes HP, Moreira EJL, Elias CN, *et al*. Cyclic fatigue of ProTaper instruments. J Endod 2007;33:55-57
9. Madarati AA, Hunter MJ, Dummer PM. Management of intracanal separated instruments. J Endod 2013;39:569-581
10. Ungerechts C, Bårdsen A, Fristad I. Instrument fracture in root canals-where, why, when and what? A study from a student clinic. Int Endod J 2014;47:183-190
11. Spili P, Parashos P, Messer HH. The impact of instrument fracture on outcome of endodontic treatment. J Endod 2005;31:845-850
12. Peters L, Van Winkelhoff AJ, Buijs J, *et al*. Effects of instrumentation, irrigation and dressing with calcium hydroxide on infection in pulpless teeth with periapical bone lesions. Int Endod J 2002;35:13-21
13. Stuart KG, Miller CH, Brown CE, *et al*. The comparative antimicrobial effect of calcium hydroxide. Oral Surg Oral Med Oral Pathol 1991;72:101-104
14. Haapasalo H, Siren E, Waltimo T, *et al*. Inactivation of local root canal medicaments by dentine: an in vitro study. Int Endod J 2000;33:126-131
15. Nerwich A, Figdor D, Messer HH. pH changes in root dentin over a 4-week period following root canal dressing with calcium hydroxide. J Endod 1993;19:302-306
16. Canakci B, Sungur R, Er Ö. Do separated instruments affect pH levels when using calcium hydroxide as intracanal dressing? Niger J Clin Pract 2019;22:1236
17. Vertucci FJ. Root canal anatomy of the human permanent teeth. Oral Surg Oral Med Oral Pathol Oral Radiol 1984;58:589-599
18. Schneider SW. A comparison of canal preparations in straight and curved root canals. Oral Surg Oral Med Oral Pathol 1971;32:271-275
19. Zmener O, Pameijer CH, Banegas G. An in vitro study of the pH of three calcium hydroxide dressing materials. Dent Traumatol 2007;23:21-25
20. Hosoya N, Takahashi G, Arai T, *et al*. Calcium concentration and pH of the periapical environment after applying calcium hydroxide into root canals in vitro. J Endod 2001;27:343-346
21. Grover C, Shetty N. Evaluation of calcium ion release and change in pH on combining calcium hydroxide with different vehicles. Contemp Clin Dent 2014;5:434
22. Fuss Z, Rafaeloff R, Tagger M, *et al*. Intracanal pH changes of calcium hydroxide pastes exposed to carbon dioxide in vitro. J Endod 1996;22:362-364
23. Schröder U. Effects of calcium hydroxide-containing pulp-capping agents on pulp cell migration, proliferation, and differentiation. J Dent Res 1985;64:541-548
24. Chamberlain TM, Kirkpatrick TC, Rutledge RE. pH changes in external root surface cavities after calcium hydroxide is placed at 1, 3 and 5mm short of the radiographic apex. Dent Traumatol 2009;25:470-474
25. Cheung GS. Instrument fracture: mechanisms, removal of fragments, and clinical outcomes. End Topics 2007;16:1-26
26. Dannemann M, Kucher M, Kirsch J, *et al*. An approach for a mathematical description of human root canals by means of elementary parameters. J Endod 2017;43:536-543

CPD questionnaire on page 222

The Continuing Professional Development (CPD) section provides for twenty general questions and five ethics questions. The section provides members with a valuable source of CPD points whilst also achieving the objective of CPD, to assure continuing education.

The importance of continuing professional development should not be underestimated, it is a career-long obligation for practicing professionals.

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.15102

A 30-year review of ameloblastoma: A tertiary hospital-based study

SADJ May 2023, Vol. 78 No.4 p184-189

AI Black[1], ML Machete[2], PD Motloba[3]

ABSTRACT

Introduction

The clinical, histological and radiographic presentation of ameloblastoma is well described in the literature. This odontogenic tumour commonly affects the mandible and is locally aggressive and destructive, resulting in disfigurement. Ameloblastoma arises from dental tissues at various phases of tooth development. They are generally asymptomatic, slow growing, locally invasive and rarely malignant with a high recurrence rate. The demographic predilection of these tumours is high in Africans, male and aged 30 years and below.

Objective

To test the hypotheses that ameloblastomas were predominant in the mandible among black Africans, males and the young.

Study design

Retrospective review of ameloblastoma cases from 1991 to 2022.

Methods

Data analysis was based on 185 histologically confirmed cases. Appropriate descriptive and inferential statistics were undertaken on age, gender, clinical, radiographic and histological characteristics.

Results

The average age was 28.81 (14.53), ranging between 3-75 years. The overall male to female ratio stood at 1.18:1. Ameloblastomas were prevalent in the mandible 174 (94.1%), diagnosed as conventional variant 155 (83.7%) and acanthomatous subtype. Radiographically, the lesions appeared as multilocular 97 (55.4%), radiolucent 100 (54.05%) and expansile 129 (67.7%). The average size of the lesions was 77.43 ± 33.83mm, with a range of 184mm.

Conclusion

Our results validate the hypothesis that ameloblastoma is highly prevalent among black Africans of younger age. The radiographic, clinical and histological characteristics of ameloblastoma in our population are comparable to the vast literature.

Keywords

Ameloblastoma, multilocular, radiolucent

Authors' information

1. Alan I Black, *BSc* (UL), *BDS* (SMU), Department of Maxillofacial and Oral Radiology, School of Oral Health Sciences, Sefako Makgatho Health Sciences University (SMU), Ga-Rankuwa, South Africa. ORCID: 0000-0003-0658-2542
2. Motimedi L Machete, *BDS* (UL), *MDS* (SMU), Registrar (MDent), Department of Community Dentistry, School of Oral Health Sciences, Sefako Makgatho Health Sciences University (SMU), GaRankuwa, South Africa. ORCID: 0000-0002-0218-8428
3. Pagollang D Motloba, *MDent* (Comm Dent) (Medunsa), *MBL* (UNISA), Head, Department of Community Dentistry. School of Oral Health Sciences, Sefako Makgatho Health Sciences University (SMU), Ga-Rankuwa, South Africa. ORCID: 0000-0003-1379-7576

Corresponding author

Name: AI Black
Email: alan.black@gauteng.gov.za

Author's contribution:

1. AI Black: Principal author 45%
2. ML Machete: Second author 20%
3. DP Motloba: Third author 35%

INTRODUCTION

Ameloblastoma is a benign tumour arising from dental tissues at various phases of tooth development.[1-4] Though rare, this tumour constitutes between 1% and 11% of all head and neck and odontogenic tumours respectively.[1] Ameloblastomas are generally asymptomatic, slow growing, locally invasive and rarely malignant; however, they exhibit high recurrence rates.[5] Unless diagnosed early, ameloblastoma can cause considerable disfigurement in affected patients.[2,6]

According to the World Health Organization's new classification of ameloblastoma, lesions are classified as benign and malignant. The benign variants include (i) unicystic ameloblastomas which are subclassified as luminal, intraluminal and/or mural, (ii) conventional ameloblastoma and (iii) peripheral ameloblastoma. Malignant lesions are classified as (i) ameloblastic carcinoma and (ii) metastasising ameloblastoma, a somewhat controversial lesion also termed "malignant ameloblastoma".

Ameloblastomas have distinct diagnostic features which were documented by Vickers and Gorlin in 1970.[7] These include the presence of peripheral palisaded columnar cells which have hyperchromatic nuclei exhibiting reverse nuclear polarisation and infranuclear vacuolation. Several histological variants have been described for the conventional form of ameloblastoma based on unique histological characteristics. These histological variants have no prognostic significance; however, the knowledge of their diversity may facilitate histological diagnosis.[5-8]

The distinction between the unicystic and conventional forms of ameloblastoma is of clinical significance which dictates the degree of surgical intervention. Unicystic ameloblastomas are most often diagnosed in the second decade of life with substantive literary evidence which supports a more conservative surgical approach for the luminal and intraluminal subtypes which may avoid aggressive resections at an age at which facial development and tooth eruption is still actively occurring.

https://doi.org/10.17159/sadj.v78i04.15102

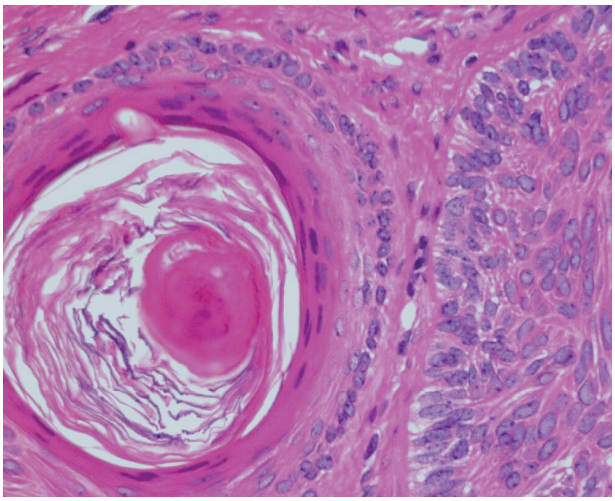


Figure 1: Acanthomatous variant, displaying how with this variant the central islands and stellate-like reticulum cells undergo squamous differentiation resembling squamous epithelium. (Haematoxylin and Eosin stained.)

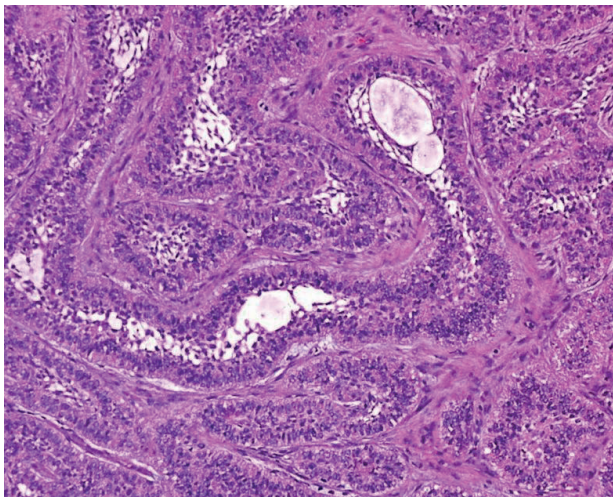


Figure 2: Haematoxylin and Eosin stain specimens showing plexiform ameloblastoma.

Conventional ameloblastoma is the most frequently diagnosed variant, affecting patients aged between 30 and 40 years.[6-9] This variant is more aggressive, highly recurrent and requires radical surgical management than other subtypes.[10,11] There are an array of histological subtypes for conventional ameloblastomas, none of which has proven to be of prognostic significance; however, knowledge of this histological diversity facilitates accurate diagnosis. The malignant forms of ameloblastoma will be surgically treated as for any form of malignant odontogenic neoplasm. The varied radiographic characteristics of ameloblastomas demonstrate differences in biological behaviour and can be of prognostic significance.[7-10] Radiographic features of prognostic importance include locularity, site and size of lesions, as well as the effects on the surrounding structures.

Lesions with ill-defined borders, cortical expansion and breakthrough often require radical surgical intervention and increase the risk of tumour recurrence.[10,12,13] There are marked clinico-demographic distributions of ameloblastoma globally. Systematic reviews and meta-analyses indicate significant patterns with regard to gender, age and site of lesions. Males are affected slightly more than females (M:F ratio = f 1.14:1; $p<0.001$); the peak incidence is at 30 years, and 90% of tumours are located within the mandible.[1,3,11-14]

The aim and clinical significance of this second largest South African study in recent times was to test the hypotheses that ameloblastomas were (i) predominant among black Africans, (ii) have male gender predilection, (iii) affected mainly young age groups, and (iv) occurred mostly in the mandible, and were large in size.

MATERIALS AND METHODS

Study design

A retrospective study was undertaken at the Sefako Makgatho Health Sciences University (SMU) to review ameloblastoma cases from 1991 to 2022.

Study population

The study population included all available records of patients diagnosed with ameloblastoma, and eligible for inclusion in this study based on the following criteria:

(i) Complete and accurate patient records (demographic details; histological reports; panoramic radiographs)
(ii) Panoramic radiographs of good diagnostic quality (cases with radiographic deterioration were excluded on the basis that they could invalidate the data collection)

Sampling and sample size

No sampling or sample size determination was undertaken for this study. It was anticipated that more than 120 records would be included in our study, which is more than most cases reported in the literature.[10,13,15]

Data collection

A specially designed data collection tool was developed to assess the following variables: (i) demographics (age and gender), (ii) clinical information, (iii) site and radiographic features, and (iv) histological characteristics.

MEASUREMENT OF VARIABLES

Clinical information

Clinical information included the main complaint and symptoms. For consistency, the following symptoms were recorded as swelling, pain, local discomfort, infection (purulent discharge), paraesthesia, delayed healing of extraction socket and tooth mobility.

Site

The site of the tumour was categorised into the following regions of the mandible: (i) anterior (incisal-canine), (ii) body (premolar-molar), (iii) posterior (distal to third molar), and (iv) bilateral regions (across the midline). Specific anatomical landmarks were recorded: the posterior which included the ramus, angle, coronoid process and condyle. In the maxilla, the tumour was sited as extending to the maxillary sinus and approaching the zygomatic arch and orbital floor. Any tumour involving two or more sites was assigned to the region approximating the centre of the lesion.

Radiographic features

Radiodensity was classified as either radiolucent, radiodense or mixed (radiolucent and radiodense). The bony margins immediately adjacent to the lesion were described as well-defined or ill-defined. Lesions were radiolucent, either unilocular (when only one compartment was present) or multilocular (when numerous adjacent compartments were present (Figures 3 and 4). Further radiographic depiction followed Worth's description of ameloblastoma.

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.15102

Figure 3: Panoramic radiograph of multilocular appearance on the left mandible area extending to the coronoid. This radiograph displays the soap bubble radiographic appearance of the entity coupled with an expansion of the cortical bone.

Accordingly, the multilocular lesions were described as being either soap bubble, honeycomb or spiderlike in appearance. If the lesion did not resemble any of these descriptions, it was recorded as "other". Signs of root resorption and/or tooth displacement were also recorded. The size of the lesions was measured in millimeters with a 150mm (6") electronic digital vernier caliper or the VUE PACS software across its widest length, between opposite borders. The panoramic radiographs were taken on a Gendex GX, Sirona ORTHOPHOSXG3 or a Kodak-Trophy K8000E (the manufacturer's specifications of magnification are between 1.25 and 1.27).

In order to standardise the settings for interpretation, all analogue radiographs examined in this study were observed on a bright and evenly illuminated light-reflecting radiograph viewing box within an enclosed room with no light entry. The digital radiographs were observed on a standardised monitor in an enclosed room with no light entry using the VUE PACS Carestream software. The expansile nature of the lesion was noted by studying its effect on the cortex of the mandible and its effect on the sinuses in the maxilla.[10]

Histology

Unicystic ameloblastomas can only be accurately subtyped histologically due to their shared radiological features. They comprise luminal, intraluminal and mural subtypes. The luminal and intraluminal subtypes are best treated by enucleation while tumours with any form of mural extension should be completely resected to prevent recurrence.

Histologically, conventional ameloblastoma will show the classical Vickers and Gorlin criteria;[7] however, variable histological growth patterns have been described. These include lesions with plexiform growth, follicular growth, acanthomatous differentiation, basaloid features, granular

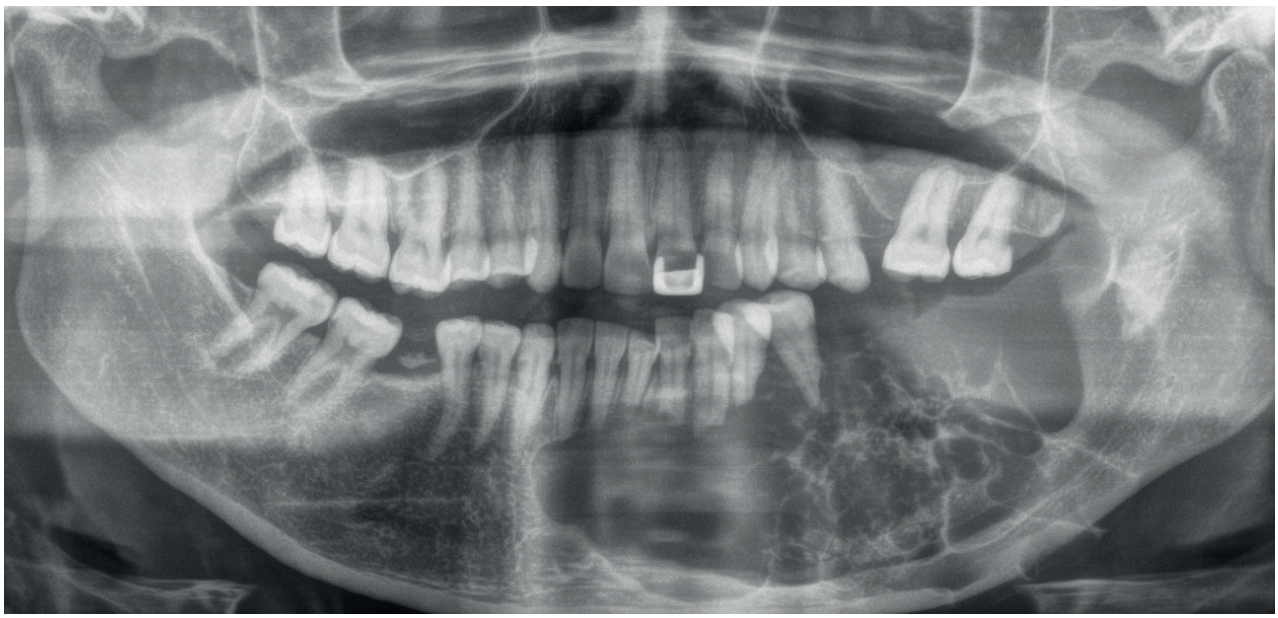


Figure 4: Panoramic radiograph of a multilocular lesion extending from the right to the left mandible. The lesion has resorbed and displaced the teeth in the mandible with a blunt appearance of the root apices. The lesion also displays a honeycomb appearance.

https://doi.org/10.17159/sadj.v78i04.15102

cell ameloblastoma, adenoid ameloblastoma and the desmoplastic subtype (Figures 1 and 2). The desmoplastic subtype of ameloblastoma was previously considered a separate form of ameloblastoma due to its unique clinico-pathological and radiological features which are often indistinguishable from fibro-osseous lesions of the jaws.

The malignant variants of ameloblastoma include the ameloblastic carcinoma and the so-called "malignant ameloblastoma". Ameloblastic carcinomas may arise de novo or may develop from a pre-existing benign conventional ameloblastoma. The typical ameloblastomatous features are abundantly clear; however, there is overt evidence of malignancy. The "malignant ameloblastoma" is a diagnosis which can only be made retrospectively. Patients will typically present with multiple tumour nodules in the lungs and will have a history of a previously resected conventional ameloblastoma. It is postulated that at the time of resection, friable fragments of tumour may inadvertently be aspirated and thus deposited in the lungs where they may continue to grow. The most significant feature of the malignant ameloblastoma is its banal, bland benign features which resemble those of the initial neoplasm which was previously resected.

In this study, the histological classification of ameloblastoma included the following types: unicystic, conventional, extraosseous peripheral metastasising (malignant), mixed or unspecified types. The subtypes comprised the following variants: acanthomatous (Figure 1), basal cell, follicular, granular cell, plexiform and combinations. The unspecified subtypes of ameloblastomas were excluded from the study.

STATISTICAL ANALYSIS

The statistical analysis was performed using IBM SPSS (Statistical Package for Social Sciences) version 28. Descriptive statistics included the measures of central tendency and dispersion (mean, standard deviation, and median and range) for numeric variables. Categorical variables were summarised using frequency and percentages. The Chi-square test and the Analysis of Variance (ANOVA) were computed to test for differences in the categorical and numeric variables between the two groups. Inferential analyses were performed at 5%.

Table 1: Age and gender distribution of ameloblastoma cases

Age (years)	Male	Female	n (%)	Ratio (M:F)
< 20	38	25	63 (34.1)	1.52:1
21 - 30	29	27	56 (30.3)	1.07:1
31 - 40	15	18	33 (17.8)	0.83:1
41 - 50	6	6	12 (6.5)	1:1
51 - 60	9	6	15 (8.1)	1.5:1
61 - 70	2	2	4 (2.2)	1:1
71+	1	1	2 (1.1)	1:1
Total	**100 (54.1)**	**85 (45.9)**	**185 (100)**	**1.18:1**

Ethical considerations

Ethical clearance to conduct this study was granted by Sefako Makgatho Health Sciences University Research and Ethics Committee SMUREC/D/112/2021: PG). The hospital manager and head of the department in the participating facility also granted permission to use the data. Participants' data were anonymised and kept confidential throughout the research process.

RESULTS

This 30-year retrospective review included 185 eligible cases of ameloblastoma. From 1991 to 2022, a total of 721 records were identified, of which 536 (74.3%) were excluded due to the following reasons: the definitive diagnosis of ameloblastoma could not be determined in three cases (3); degraded radiographs (22); duplicates (11) and missing biographical data (9). Most excluded records were due to ineligible radiographic images – a total of 462 specimens did not have accompanying radiographs. These patients were referred from departments outside the SMU SOHS, which makes it difficult to access all the critical radiographic data. Eighteen accompanying radiographs were not panoramic but Lateral Obliques (2), Posterior Anterior view

Table 2: Distribution of ameloblastoma by site and gender

Site (Subtotal)	Gender n (%)		Total
	Male	Female	
Maxilla	5 (45.5)	6 (54.5)	11 (5.9)
Mandible	95 (54.6)	79 (45.4)	174 (94.1)
Body (symphysis, parasymphysis, angle)	58 (55.2)	47 (44.8)	105 (56.8)
Body and Ramus	19 (47.5)	21 (52.5)	40 (21.6)
Ramus, Condyle and Coronoid process	1 (33.3)	2 (66.7)	3 (1.6)
Body, Ramus, Condyle and Coronoid process	17 (65.4)	9 (34.6)	26 (14.1)
Total	**100 (54.1)**	**85 (45.9)**	**185 (100)**

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.15102

Table 3: Radiographic features of ameloblastoma

Locularity	Radiodensity		
Multilocular	Lucent	Mixed	Total
Soap bubble	13	23	36
Honeycomb	1	8	9
Spiderlike	1	0	1
Other	13	38	51
Unilocular	72	16	88
Total	**100**	**85**	**185**

Table 4: Effect of ameloblastoma on surrounding structures

	Expansile		
	Yes	**No**	**Total**
Root resorption and displacement	91	27	118
Root/tooth displacement	18	16	34
Root resorption	8	6	14
No effect	0	1	1
No teeth	12	6	18
Total	**129**	**56**	**185**

(3), Cone Beam Computer Tomography (10) and intra-oral radiographs (3). (The parenthesis indicates the number of radiographic images that were excluded in relation to the respective radiographic procedure.) We found that 11 images from the panoramic radiographs were beyond the focal trough; consequently, the dimensions of the lesion could not be measured and radiographic classification confirmed. Presented in table 1, are the demographic, radiographic and histological features of the 185 eligible cases of ameloblastoma.

Age and gender distribution of ameloblastoma

The average age of patients in this study was 28.81 years (14.53 Standard deviation), ranging from 3-75 years. The majority of ameloblastomas 152 (82.2%) were prevalent in patients 40 years and younger and were more common in males 100 (54.1%) than females 85 (45.9%). The overall male to female ratio stood at 1.18:1. A two-sided Fisher's exact test (FET) showed no association between age and gender (p=0.869).

Site distribution of ameloblastoma

Ameloblastoma was most prevalent in the mandible 174 (94.1%); of these males were more affected than females – 95 (54.6%) and 79 (45.4%) respectively. These differences in the site and gender distribution were not statistically significant (p=0.575). The maxilla accounted for 11 (5.9%) of the cases, which were approximately equally distributed among the genders (Table 2).

Histopathological features

The tumour classification showed the predominance of the conventional variant 155 (83.7%), with fewer of the unicystic and the-metastasising types, 29 (15.7%) and 1 (0.5%) respectively. Subtyping of 66 (35.7%) conventional ameloblastomas resulted in 36 acanthomatous, 15 plexiform, 10 follicular and 5 granular cell variants. This information was collected from archived histologic reports that were compiled and signed off by at least 2 oral pathologists using the diagnostic criteria that were considered the standard at the time. The histologic reports had additional information in the form of what additional cell type was present above and beyond the main ameloblastoma type; this information was then used to subtype into the different subtypes as described above.

Radiographic features

The majority of ameloblastomas were multilocular 97 (52.44%), radiolucent 100 (54.05%) and expansile 129 (69.7%). More than one-third (36/97) of multilocular lesions exhibited a soap bubble appearance. Approximately 129 (69.73%) of ameloblastomas had effects on the adjacent structures which included root resorption 8 (4.32%) cases, displacement of teeth 18 cases (9.73%) and a combination of resorption and displacement 91 cases (49.20%). Only one case displayed no effect on adjacent dentition, while for 18 cases, there were no teeth adjacent to the lesion (Tables 3 and 4).

Size of ameloblastomas

The average size of the diagnosed lesions was 77.43 ± 33.83mm, with a range of 184mm (3 – 187). Respective hypotheses evaluated the association of gender and age with the size of the lesion. ANOVA revealed that the mean size of ameloblastoma was greater in males (77.96±33.28) mm than in females (76.82±34.67) mm. However, this difference was not statistically significant (p=082). Similarly, the independent Kruskal – Wallis test showed no differences in lesion dimensions across the age groups (p=0.93). Compared to the maxilla, the mandibular lesions were dimensionally larger (mean 78.61mm versus 60.40mm); however, the differences were not significant (p=0.071). Statistically significant differences were found on the lesion dimensions and expansiveness (yes or no); effects on adjacent structures (yes or no) and locularity (multilocular vs unilocular). The associated statistical probabilities were p<0.001, 0.002 and p<0.001.

DISCUSSION

The purpose of this review was to gain a better understanding of the histological and radiographic characteristics of ameloblastoma in South Africa. There are four major findings of this study. First, ameloblastomas are most common in males under 30 years of age. Second, the condition occurs predominately in the mandible presenting as large expansile masses with cortical expansion with effects on adjacent structures. Third, on radiographic analysis ameloblastomas presented mainly as multilocular, radiolucent lesions with a soap bubble appearance. Fourth, histologically, most lesions represented conventional ameloblastomas of the acanthomatous subtype.

This large South African study directly demonstrates the demographic distribution of ameloblastoma. This demographic pattern is consistent with the published literature.[16-19] According to the recent meta-analysis, the global gender distribution of ameloblastoma is estimated to be 1.14:1 (M:F). Continent-specific approximations were as

https://doi.org/10.17159/sadj.v78i04.15102

follows: Africa 1.20:1; North America 1.45:1; Asia 1.16:1 and Australia 1.73:1. These figures are comparable to our study results of 1.18:1 and 1.05:1, Ranchod *et al*.[11] However, the European and South American studies reported the predominance of ameloblastoma in women as compared to men with ratios of 1.14:1 and 1.25:1 respectively.[14] This female gender predisposition confers no credible evidence or hypothesis for the female gender as a risk factor for the development of ameloblastoma; the same can be said in men as both genders are likely to exhibit the entity.

When comparing our results to those of Ranchod *et al*[11], notably the age at which ameloblastoma is diagnosed has reduced over time, especially among African patients. The study of Ranchod *et al* and this study support the hypothesis that the incidence of ameloblastoma is predominant in younger patients. Our study of 185 African patients yielded a mean age of 28.81 years, while in the Ranchod study 49 African patients contributed to a mean of 32.99 years.[11] These South African findings are congruent with studies that have confirmed the global peak incidence of ameloblastoma before the third decade among persons of African descent.[14,19] It remains unclear to what degree the incidence of ameloblastoma at the age of 30 years or before is associated with African ancestry. It is, however, postulated that dire socioeconomic circumstances and inability to obtain adequate oral health treatment may render individuals more susceptible to the entity which can usually present itself at routine screenings or oral examinations. In these cases, lack of proper nutrition and limited access to appropriate medical care predispose Africans and South Americans to the early development of ameloblastomas. The association of genetic and socioenvironmental factors offers a plausible hypothesis for the development of ameloblastomas. However, this theory needs to be tested in well-controlled prospective longitudinal studies.

We found that the acanthomatous variant of conventional ameloblastoma was the most common histological subtype (54.54%). This is in contrast to the global data, which indicates that the most observed histological subtypes are follicular or plexiform variants.[8,20] This finding is notable but inconsequential since it is well established that the histological subtypes do not have any meaningful effects on the treatment and prognosis. Multilocular ameloblastomas accounted for just over half of the lesions (52.44%) observed on Panoramic radiographs. This observation, though modestly lower, is consistent with what has been found in previous studies.[11,21,22] On the contrary, unilocularity was significantly associated with younger age, X^2 (1,185) = 12.26, p <0.001). Based on the natural progression of the tumour, initial lesions are small and unilocular. However, as the tumour matures and expands it assumes a multilocular pattern. Ameloblastomas caused root resorption and displacement of teeth was observed in half of the subjects. This effect was conservative compared to Ranchod[11] Struthers[23] and Martins[24]. Given the common effects of the tumour on the roots of teeth, ameloblastoma should be considered as part of any differential diagnosis where root resorption is present in young patients especially when there are no related symptoms. The mean size of ameloblastoma was 77.43mm, this result ties well with a local study by Ranchod *et al*[11] (mean = 86.39mm). These data show that ameloblastomas in the South African population were highly expansile, affected adjacent structures and caused disfigurement. It is hypothesised that patients who wait longer without any medical intervention will present with large neoplasms. The delays can be attributed to socioeconomic circumstances and inaccessible specialist oral health care services in these regions. Furthermore, malignant neoplasms are surgically prioritised while ameloblastoma, being benign, results in prolonged waiting times for surgical resection which often results in the development of massive lesions which then require extensive reconstruction and increase the risk of recurrence.

LIMITATIONS OF THE STUDY

A major concern is the exclusion of 536 cases,which underpowers the study, making it susceptible to random error. This methodological challenge can potentially invalidate the study results. However, our sample size is comparable to many published studies which could mitigate the minimal effect of random error and validate the study findings.

CONCLUSION

Our findings support the hypothesis that ameloblastoma is highly prevalent among black Africans of younger age. Furthermore, the lesions are highly expansile, larger in size and result in serious facial deformity. The radiographic, clinical and histological characteristics of ameloblastoma in our population are comparable to the vast literature.

REFERENCES

1. Angadi PV. Head and neck: odontogenic tumor: ameloblastoma. Atlas of Genetics and Cytogenetics in Oncology and Haematology. 2011
2. Masthan KM, Anitha N, Krupaa J, Manikkam S. Ameloblastoma. J Pharm Bioallied Sci. 2015;7(Suppl 1):S167-170
3. Rajendra Santosh AB, Ogle OE. Odontogenic Tumors. Dent Clin North Am. 2020;64(1):121-138
4. Kreppel M, Zöller J. Ameloblastoma - Clinical, radiological, and therapeutic findings. Oral diseases. 2018;24(1-2):63-66
5. Effiom O, Ogundana O, Akinshipo A, Akintoye S. Ameloblastoma: current etiopathological concepts and management. Oral diseases. 2018;24(3):307-316
6. Milman T, Ying GS, Pan W, LiVolsi V. Ameloblastoma: 25-Year Experience at a Single Institution. Head Neck Pathol. 2016;10(4):513-520
7. Vickers RA, Gorlin RJ. Ameloblastoma: Delineation of early histopathologic features of neoplasia. Cancer. 1970;26(3):699-710
8. Cadavid AMH, Araujo JP, Coutinho-Camillo CM, Bologna S, Junior CAL, Lourenço SV. Ameloblastomas: current aspects of the new WHO classification in an analysis of 136 cases. Surgical and Experimental Pathology. 2019;2(1)
9. Tatapudi R, Samad SA, Reddy RS, Boddu NK. Prevalence of ameloblastoma: A three-year retrospective study. Journal of Indian Academy of Oral Medicine and Radiology. 2014;26(2):145
10. Hertog D, Bloemena E, Aartman IHA, van-der-Waal I. Histopathology of ameloblastoma of the jaws; some critical observations based on a 40 years single institution experience. Med Oral Patol Oral Cir Bucal. 2012;17(1):e76-e82
11. Ranchod S, Titinchi F, Behardien N, Morkel J. Ameloblastoma of the mandible: analysis of radiographic and histopathological features. Journal of Oral Medicine and Oral Surgery. 2020;27(1)
12. Jayachandran. Imaging Analysis of Ameloblastoma of Mandible – 5 Cases. Journal of Analytical Oncology. 2012
13. Kim SG, Jang HS. Ameloblastoma: a clinical, radiographic, and histopathologic analysis of 71 cases. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2001;91(6):649-653
14. Hendra FN, Van Cann EM, Helder MN, *et al*. Global incidence and profile of ameloblastoma: A systematic review and meta-analysis. Oral Diseases. 2020;26(1):12-21
15. Giraddi GB, Arora K, Saifi AM. Ameloblastoma: A retrospective analysis of 31 cases. J Oral Biol Craniofac Res. 2017;7(3):206-211
16. Laborde A, Nicot R, Wojcik T, Ferri J, Raoul G. Ameloblastoma of the jaws: Management and recurrence rate. European annals of otorhinolaryngology, head and neck diseases. 2017;134(1):7-11
17. Arotiba GT HJ, Guthua S W, Adeola H, Odhiambo W, Effiom OA, Osundwa T, Kirimi J, Dimba E, Olojede, ACO, Gbotolorun, OM, Adamson O. Ameloblastoma in Black Africans the Need for Multi-National Collaborative Research. JSM Dent Surg. 2017;2(2):1014
18. MM Chidzonga aVMLP, b and AL. Portilla Alvarez, b Avondale, Harare, Zimbabwe aCdA, Cuba. Ameloblastoma analysis of 207 cases in a Nigerian teaching hospital. Quitessence international. 2008
19. Reichart P, Philipsen H, Sonner S. Ameloblastoma: biological profile of 3677 cases. European Journal of Cancer Part B: Oral Oncology. 1995;31(2):86-99
20. Bwambale P, Yahaya JJ, Owor G, Wabinga H. Histopathological patterns and biological characteristics of ameloblastoma: A retrospective cross-sectional study. Journal of Taibah University Medical Sciences. 2022;17(1):96-104
21. Chawla R, Ramalingam K, Sarkar A, Muddiah S. Ninety-one cases of ameloblastoma in an Indian population: A comprehensive review. J Nat Sci Biol Med. 2013;4(2):310-315
22. Ogunsalu C, Daisley H, Henry K, *et al*. A new radiological classification for ameloblastoma based on analysis of 19 cases. West Indian Med J. 2006;55(6):434-439
23. Struthers P, Shear M. Root resorption by ameloblastomas and cysts of the jaws. International Journal of Oral Surgery. 1976;5(3):128-132
24. Martins GG, Oliveira IA, Consolaro A. The mechanism: how dental resorptions occur in ameloblastoma. Dental Press J Orthod. 2019;24(4):21-32

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.15177

A pre and post-test assessment of an oral health intervention: caregivers' knowledge and attitudes at long-term care facilities in the eThekwini district, KwaZulu-Natal

SADJ May 2023, Vol. 78 No.4 p190-195

S Balwanth[1], S Singh[2]

ABSTRACT

Introduction

Oral health remains a neglected aspect of healthcare among vulnerable populations residing at long-term care (LTC) facilities. Routine oral health education and training for caregivers have the potential to improve oral health provision.

Aims and objective

To determine the effect of an oral health intervention on caregivers' knowledge and attitudes.

Methods

This cross-sectional study utilised a pre/post-test assessment approach. A total of n=145 caregivers from n=7 LTC facilities in the eThekwini district, participated in a pre-test questionnaire. An oral health education intervention in the form of a PowerPoint® presentation was implemented four weeks later. Six months later, a post-test questionnaire was administered. A Paired proportion test was used for statistical analysis. A p-value ≤0.05 was considered to be statistically significant.

Results

A response rate of 77.1% was obtained. In the pre-intervention phase, caregivers (n=68; 46.9%) reported that loose teeth can be a sign of gum and bone disease, compared to 89% (n=129) of caregivers in the post-intervention phase. Caregivers (n=124; 85.5%) in the pre-intervention phase felt that they should be trained in providing oral healthcare, compared to 93.8% (n=136) in the post-intervention phase.

Conclusion

The oral health intervention had a positive effect on caregivers' knowledge and attitudes. This finding necessitates routine oral health education and training for caregivers.

Keywords

Caregivers, long-term care facilities, institutionalised residents, oral health education, oral health training

Authors' information

1. S Balwanth, BChD, PG Dip Int Ortho (UWC), MMedSc (UKZN), Discipline of Dentistry, School of Health Sciences, University of KwaZulu-Natal, South Africa. E: sonambalwanth7@gmail.com ORCID: 0000-0003-2991-399X
2. S Singh, PhD. B.OH, M.Sc (Dent), PhD (UWC), PG Dip Heal Res Ethics (Stellenbosch), PhD Clin and Res Ethics (Stellenbosch). Professor, Discipline of Dentistry, School of Health Sciences, University of KwaZulu-Natal, South Africa

Corresponding author

Name: S Singh
Tel: +27 31 2428591
Email: singhshen@ukzn.ac.za

Author's contribution:

1. S Balwanth Primary author 70%
2. S Singh Secondary author 30%

INTRODUCTION

Oral disease is a major public health concern due to the high prevalence and debilitating social impact on individuals globally.[1,2] The prevalence of oral disease is significantly higher in dependent populations with special needs, including the elderly population, vulnerable children and cognitively or physically impaired individuals residing at LTC facilities.[3,4,5,6] Poor oral health among residents at LTC facilities, present with far reaching consequences and have implications on preventive, promotional and future dental treatment.[3,7,8,9] Previous international studies have postulated that the higher incidence of oral disease among institutionalised residents could be attributed to barriers in accessing appropriate oral healthcare.[7,10] These barriers include: cost of oral healthcare services, residents' impaired mental abilities or limited physical dexterity, low perceived need for oral care by residents and caregivers, and caregivers' lack of oral health knowledge.[7,11] Caregivers are expected to play an important role in the prevention of oral disease and deliverance of appropriate and adequate oral healthcare to satisfy the special oral health needs of residents at LTC facilities. This, however, may not always be realised due to prioritisation of other caregiving duties resulting in a deficiency of time, a lack of knowledge and skills in oral healthcare, non-communicative and uncooperative residents, and a lack of understanding of the importance of oral health among caregivers.[7,10]

Numerous international studies have identified the lack of adequate oral health knowledge among caregivers as a recurrent contributing factor to poor oral health among institutionalised residents.[1,7,1] Consequently, substantial international literature has highlighted the importance and effectiveness of oral health education in a variety of settings, including LTC facilities.[1,6,7,10,12,13] It was found that the success of oral health education depends on the co-operation of caregivers and regular in-service training with frequent monitoring.[7] Integration of oral healthcare services into routine

https://doi.org/10.17159/sadj.v78i04.15177

healthcare services is another fundamental method in achieving better oral health outcomes and, in turn, better overall quality of life for individuals.[1] This can be achieved through collaboration with nursing staff, and dental and medical professionals, in the provision of healthcare services for institutionalised residents.[14] Additionally, incorporating oral examinations into routine care by caregivers has been reported by several authors as a useful tool in improving institutionalised residents' oral health.[11,15,16]

Caregivers are often the first healthcare providers and thus have a responsibility and duty in providing oral healthcare to the institutionalised residents.[18] Caregivers' oral health related knowledge and skills may directly or indirectly affect the quality of care rendered to the residents. There is a paucity of information available in South Africa exploring the oral health related knowledge and attitudes among caregivers. Thus, the aim of this study was to evaluate the impact of an oral health education intervention among caregivers at LTC facilities in the eThekwini district. The scientific hypothesis of the study was that oral health education intervention for caregivers would result in an improvement in their oral health related knowledge, attitudes and, in turn, practices.

METHODS

The study utilised a cross-sectional, analytical and comparative research design and a pre/post-test assessment approach. Study sites included n=39 LTC facilities operated by non-profit organisations selected from "eThekwini health and well-being service provider directory 2018" and n=28 private or semi-privately operated LTC facilities from a website called "Senior service retirement places" on search engine company Google.[19,20] Every facility from the above-mentioned directory and website were purposively included in the selection process. A total of seven (n=7) long-term care facilities participated in the study, which included six (n=6) old age homes and one (n=1) children's home in eThekwini, all of which offer long-term care. Caregivers at the participating LTC facilities were purposively sampled using a criterion and snowball sampling technique. A sample of one hundred and eighty-eight (n=188) questionnaires were distributed among voluntary participants of which one hundred and forty-five (n=145) were suitable for further analysis, yielding a response rate of 77.1%.

Prior to conducting the research, details of the study were explained and written permission was obtained from managers of each facility. Participants were invited to partake in the study and informed consent was obtained. Study participants were informed that the study was voluntary and were free to withdraw from the study at any stage, without any negative consequences.

In consultation with the gatekeepers of each facility, overseeing the completion of the questionnaires was not permissible due to the Covid-19 risk. In keeping with Covid-19 protocols and policy of each facility, in order to minimise contact with staff and caregivers the pre and post-test self-administered questionnaires were distributed to participating caregivers by the managers or nurses of each facility.

A pre-test self-administered questionnaire was distributed among participants and used to gather baseline quantitative data. An oral health education intervention in the form of a PowerPoint® presentation was implemented one month later. Six months later, a post-test self-administered questionnaire was distributed among the same participants to evaluate the effect of the oral health education intervention.

A 15-item questionnaire was developed in English to assess caregivers' oral health related knowledge and attitudes pre and post-intervention. The first section of the questionnaire included questions on participants' biographical information such as: gender, age, level of education and years of work experience. The second part included questions on knowledge such as: denture care, recognition and management of common oral conditions, recognition of oral side effects of medications, nutrition and diet, and paediatric dentistry in the form of a Likert scale with the format of responses: 1-strongly agree, 2-agree, 3-not sure, 4-disagree and 5-strongly disagree. Other questions included knowledge of oral hygiene, understanding of dental terms and mechanism of dental decay. The third part of the questionnaire focused on participants' attitudes regarding care for residents, recognition of residents' special oral health requirements, oral health training and existing oral health protocols, which was presented in the form of a Likert scale. Closed ended questions were used in this questionnaire. The oral health education intervention in the form of a PowerPoint® presentation, focused on the importance of the caregivers' role in maintaining adequate oral hygiene for the residents, which included management of common oral conditions, special oral health care practices for residents, diet and nutrition, and proper oral hygiene instructions such as brushing and flossing techniques. Video clips demonstrating proper oral hygiene and brushing techniques and utilising dental aids were also included. The oral health education intervention was based on guidelines outlined by the World Health Organisation.[21] The researcher provided the participants with toothbrushes, toothpaste, flossing aids and pamphlets on oral hygiene education to enhance the effectiveness of the oral health education intervention.

Before commencing the study, a pilot study was conducted among (n=8) caregivers at a long-term care facility in eThekwini, who were excluded from the final questionnaire. Inconsistencies, ambiguity and grammatical errors were rectified before conduction of the study.

Pre and post-test evaluation of oral health scores were performed using the same semi-structured self-administered questionnaire. The collected data were entered into Microsoft Excel 2007 and subjected to statistical analysis using SPSS version 27.0 (IBM Statistics Inc, Chicago, Illinois, USA). The Paired proportion test was used to find the significance of change in proportion from pre to post-intervention. A p-value ≤ 0.05 was considered to be statistically significant.

The study was granted ethical clearance by the Biomedical Research Ethics Committee at the University of KwaZulu-Natal (BREC/00002633/2021). All other ethical issues, such as confidentiality and anonymity, were maintained.

RESULTS

Socio-demographic profile of caregivers

All participants were females with the majority being within the age group 37-42 years old (n=37; 25.5%), holding a secondary level of education (n=99; 68.3%), and having had 6-10 years of caregiving experience (n=69; 47.6%), as demonstrated in Table 1.

Pre and post-test evaluation of caregivers' oral health related knowledge

About 16.6% (n=24) of the caregivers disagreed with the statement that a person can chew and eat as well with false teeth (dentures) as with natural teeth in the pre-intervention phase, compared to 50.3% of the study sample (n=73) in the post-intervention evaluation who disagreed with the statement, as demonstrated in Table 2.

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.15177

Table I. Participants' sociodemographic profile

Variable	Categories	n (%)
Gender	Female	145 (100)
	Male	0 (0)
Age group	24-29 years old	18 (12.4)
	30-36 years old	36 (24.8)
	37-42 years old	37 (25.5)
	43-47 years old	33 (22.8)
	48-53 years old	12 (8.3)
	54-59 years old	8 (5.5)
	60-66 years old	1 (0.7)
Level of education	No formal schooling	2 (1.4)
	Secondary education	99 (68.3)
	Tertiary education	44 (30.3)
Work experience	1-5 years	44 (30.3)
	6-10 years	69 (47.6)
	11-15 years	28 (19.3)
	>15 years	4 (2.8)

Before the oral health education intervention, less than half of the caregivers (n=63; 43.4%) agreed that false teeth (dentures) that do not fit well can cause ulcers and, in some cases, oral cancer. In the post-intervention evaluation, the majority of the caregivers (n=112; 77.2%) agreed with the statement.

With regard to the statement: "Losing teeth is expected as part of the ageing process", few caregivers (n=20; 13.8%) disagreed with the statement in the pre-intervention phase. In the post-intervention evaluation, 57.9% of the caregivers (n=84) disagreed with the statement. Less than half of the caregivers (n=68; 46.9%) in the pre-intervention phase agreed that loose teeth can sometimes be a sign of gum and bone disease, while 89% of caregivers (n=129) in the post-intervention agreed.

Some participants (n=61; 42.1%) in the pre-intervention phase indicated that dry mouth management can include chewing on ice chips and sugar-free gum, compared to n=108 caregivers (74.5%) in the post-intervention phase with the same response.

In the pre-intervention phase, 49.7% of the caregivers (n=72) disagreed with the statement: "Drinking an adequate amount of water between meals is not very beneficial in maintaining good oral health", compared to 60% of caregivers (n=87) in the post-intervention evaluation who disagreed. Caregivers' theoretical oral health related knowledge pre and post-intervention is demonstrated in Table 3.

Table 2. Pre and post-test evaluation of caregivers' clinical oral health related knowledge

	Pre-test				Post-test				
Statements on knowledge	Agree n (%)	Unsure n (%)	Disagree n (%)	Mean value	Agree n (%)	Unsure n (%)	Disagree n (%)	Mean value	p-value
A person can chew and eat just as well with false teeth (dentures) as with natural teeth	104 (71.7)	17 (11.7)	24 (16.6)	2.45	66 (45.5)	6 (4.1)	73 (50.3)	3.05	<0.001**
False teeth (dentures) that don't fit well can cause ulcers and, in some cases, oral cancer	63 (43.4)	49 (33.8)	33 (22.8)	2.79	112 (77.2)	12 (8.3)	21 (14.5)	2.37	<0.001**
Losing teeth is expected as part of the ageing process	110 (75.9)	15 (10.3)	20 (13.8)	2.38	58 (40)	3 (2.1)	84 (57.9)	3.18	<0.001**
Loose teeth can sometimes be a sign of gum and bone disease	68 (46.9)	42 (29)	35 (24.1)	2.77	129 (89)	8 (5.5)	8 (8.5)	2.17	<0.001**
Dry mouth management can include chewing on ice chips and sugar-free gum	61 (42.1)	47 (32.4)	37 (25.5)	2.83	108 (74.5)	29 (20)	8 (5.5)	2.31	<0.001**
Mouth rinsing is a good alternative to daily brushing teeth and flossing	102 (70.3)	16 (11)	27 (18.6)	2.48	79 (54.5)	6 (4.1)	60 (41.4)	2.87	<0.001**
Drinking an adequate amount of water between meals is not very beneficial in maintaining good oral health	45 (31)	28 (19.3)	72 (49.7)	3.19	40 (27.6)	18 (12.4)	87 (60)	3.32	0.150
Cleaning the tongue by brushing or scraping is a very important part of oral hygiene practices	122 (84.1)	7 (4.8)	16 (11)	2.97	138 (95.2)	3 (2.1)	4 (2.8)	3.62	<0.001**
In children, decayed teeth are normal and do not need to be treated as they will fall out soon	66 (45.5)	17 (11.7)	62 (42.8)	3.46	24 (16.6)	7 (4.8)	114 (78.6)	3.77	<0.001**
Smelly breath in children is normal	31 (21.4)	16 (11)	98 (67.6)		14 (9.7)	5 (3.4)	126 (86.9)		<0.001**

**Statistically significant p≤0.05

https://doi.org/10.17159/sadj.v78i04.15177

Table 3. Pre and post-test evaluation of caregivers' theoretical oral health related knowledge

Statements	Pre-test n (%)	Post-test n (%)
Calculus is a germ-containing substance that collects on the surface of the teeth, calcifies and causes gum and bone disease over a period of time.	36 (24.8)	114 (78.6)
Fluoride has been proven to prevent tooth decay and helps strengthen teeth.	104 (71.7)	128 (88.3)
Plaque is a germ-containing substance that collects on the surface of teeth and causes decay.	68 (46.9)	120 (82.8)
Bacteria in the mouth stick on to the sugary tooth surface and create acid which leads to the formation of cavities.	58 (40)	107 (73.8)

ATTITUDES

Less than half of the participants (n=54; 37.2%) in the pre-intervention phase reported that insufficient oral health promotion and education has been provided for caregivers and residents at LTC facilities. In the post-intervention evaluation, 46.2% of caregivers (n=67) had the same response, as illustrated in Table 4.

Most of the sample population (n=124; 85.5%) indicated to feel that caregivers should be trained to perform oral screening and provide oral health education for residents in the pre-intervention phase, compared to almost all participants (n=136; 93.8%) in the post-intervention evaluation who shared the same sentiment.

With regard to the statement: "I feel there are no guidelines on how to manage the oral needs of residents at long-term care facilities", before the oral health intervention, 35.2% of the caregivers n=51 agreed with the statement. In the post-intervention evaluation, 42.1% of caregivers n=61 reported to feel the same.

DISCUSSION

All participants in the study were female, which coincides with several studies involving caregivers at LTC facilities.[22,23,24] A possible reason for this could be attributed to the perceived cultural stereotype where jobs involving care and nurturing are reserved for females.[24] The majority of the caregivers in the current study reported to hold a secondary level of education (68.3%). Similarly, a study evaluating the impact of an oral health educational programme for caregivers of institutionalised residents found that the majority of caregivers (64.3%) had only obtained elementary school education.[12] Walid, Nasir and Naidoo, (2004) suggested that although not ideal, in developing and underresourced countries such as South Africa, non-healthcare workers can contribute to the promotion of oral health through training and education and, in turn, improve oral health outcomes for residents at LTC facilities. [25]

Oral health related knowledge among caregivers

The results of the study indicated that caregivers' overall oral health knowledge increased from baseline to post-intervention. Similar studies have postulated that implementation of oral health interventions, regardless of the measured variables, may result in better oral health outcomes for institutionalised residents due to improved knowledge among caregivers.[12,26]

Due to physical and cognitive limitations, self-care oral hygiene practices may not be adequate, inevitably resulting in unmet oral health needs and reduced quality of life among residents.[2] Thus, caregivers have a significant responsibility towards providing residents with optimal oral healthcare. However, numerous studies have reported that the oral health knowledge among caregivers is inadequate, perpetuating poor oral health among residents.[1,3,7,12,27,2] Therefore, many authors have postulated that by improving oral health knowledge among caregivers through education and training, oral hygiene practices among care-dependent residents could improve.[10,22,2 ,30]

Caregivers (n=73; 50.3%) in the post-intervention phase acknowledged that individuals with dentures cannot chew as efficiently as those individuals with natural teeth. Hence, caregivers also play an important motivational role in advising and assisting denture wearing residents with proper denture education, including food selections, in order to avoid gastro-intestinal ailments and nutritional deficiencies.[8] The majority of the caregivers (n=112; 77.2%) in the post-intervention phase reported that ill-fitting dentures can cause ulcers and, in some cases, oral cancer. This finding concurs with a study conducted by Manoharan, Nagaraja and Eslick (2014), who found that the use of dentures – and more so ill-fitting dentures – increases the risk of developing cancer. It is thus imperative that caregivers' knowledge in denture care be optimal and that preventive measures such as oral screenings and checking of dentures are made mandatory at LTC facilities, in order to prevent denture related conditions such as denture stomatitis, oral candidiasis and ulcerations, which can manifest into more sinister conditions if left untreated.[8,31]

Vulnerable, abandoned and disadvantaged children form a socially marginalised population and therefore tend to experience more oral diseases.[32] Khedekar *et al*. (2015) investigated the oral hygiene status of orphanage children in India and found that the majority of the orphaned children (59%) had experienced toothache and almost all children did not visit the dentist.[32] In the current study, caregivers' knowledge regarding the importance of seeking professional dental treatment for decayed teeth in children in the pre-intervention phase was low (n=62; 42.8%). This finding highlights the fact that children's oral health is neglected and not deemed a priority by caregivers, which can be attributed to the lack of knowledge and expertise among caregivers in recognising symptoms of dental diseases. Khedekar *et al*. (2015) further found that bad breath and bleeding gums were a common finding among the children at the orphanage in India.[32] Some caregivers (n=31; 21,4%) in the pre-intervention phase reported that smelly breath in children was normal, which raises a major concern with regard to a lack of oral hygiene reinforcement by caregivers and indicates a lack of paediatric dental knowledge. While this response decreased (n=14; 9.7%) following the oral health intervention, the documented high prevalence of

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.15177

Table IV. Pre and post-test evaluation of caregivers' oral health attitudes

Statements on attitude	Pre-test				Post-test				
	Agree n (%)	Unsure n (%)	Disagree n (%)	Mean value	Agree n (%)	Unsure n (%)	Disagree n (%)	Mean value	p-value
I feel compassion and a desire to improve the oral health status of residents at long-term care facilities	126 (86.9)	12 (8.3)	7 (4.8)	2.01	132 (91)	12 (8.3)	1 (0.7)	1.87	0.103
I am afraid of performing oral screening for residents at long-term care facilities because they might infect me	15 (10.3)	9 (6.2)	121 (83.4)	3.80	7 (4.8)	19 (13.1)	119 (82.1)	4.00	0.063
I am unaware of the special oral needs of residents at long-term care facilities	36 (24.8)	16 (11)	93 (64.1)	3.46	60 (41.4)	11 (7.6)	74 (51)	3.06	0.003
Not enough oral health promotion and education is provided for caregivers and residents at long-term care facilities	54 (37.2)	31 (21.4)	60 (41.4)	3.02	67 (46.2)	16 (11)	62 (42.8)	2.92	0.250
I feel it is my duty as a caregiver to provide optimal oral health services to residents at long-term care facilities	128 (88.3)	5 (3.4)	12 (8.3)	1.98	134 (92.4)	9 (6.2)	2 (1.4)	1.77	0.056
I feel that caregivers should be trained to perform oral screening and oral health education for residents	124 (85.5)	6 (4.1)	15 (10.3)	2.08	136 (93.8)	4 (2.8)	5 (3.4)	1.79	0.009**
I feel there are no guidelines on how to manage the oral needs of residents at long-term care facilities	51 (35.2)	22 (15.2)	72 (49.7)	3.12	61 (42.1)	22 (15.2)	62 (42.8)	2.94	0.131

**Statistically significant p≤0.05

dental caries and oral disease among children residing in orphanages necessitates more attention towards improving the knowledge and skills of caregivers and creating oral health awareness at LTC facilities. Likewise, both authors Khedekar *et al*. (2015) and Bushra and Othman (2022) noted significant improvement in caregivers' knowledge, attitudes and practices following an oral health education programme involving oral health provision for orphaned children.[32,33]

Oral health related attitudes among caregivers

Almost all caregivers (n=132; 91%) in the post-intervention phase expressed compassion and optimism to improve the oral health status of the residents under their care and felt that providing optimal oral healthcare to the institutionalised residents was their desire and duty (n=134; 92.4%). Conversely, Cornejo-Ovalle *et al*. (2013) found that approximately one third of caregivers felt obligated to work at a LTC facility for the elderly because of necessity.[24]

Additionally, Wardh, Andersson and Sorensen (1997) found that caregivers were not keen on cleaning the residents' mouths and preferred conducting other nursing duties, in effect neglecting the residents' oral health.[34] Encouraging was the finding that the majority of caregivers (n=119; 82.1%) in the current study's post-intervention phase were not afraid to examine the residents' mouths and perform oral screenings. The post-intervention results indicated that many caregivers (n=67; 46.2%) felt that insufficient oral health promotion and education programmes were conducted at LTC facilities, and 42.1% of the caregivers (n=61) reported to feel that there were no guidelines on how to manage the special oral needs of residents. These findings are significant as they highlight the lack of oral health prioritisation at LTC facilities and indicate the dire need for clear oral health guidelines and protocols.

Almost all caregivers in the post-intervention phase of the current study (n=136; 93.8%) strongly felt that they should be trained to perform oral screenings and oral health education for residents. Similarly, studies conducted by Lago *et al*. (2017) and Cornejo-Ovalle *et al*. (2013) found that caregivers at LTC facilities reported to request more training in oral health.[12,24] The finding of the current study necessitates the implementation of oral health education for caregivers as a means to prioritise and promote oral health and, in turn, provide adequate oral health services to the residents at LTC facilities. Petrovski *et al*. (2019), proposed that oral health education programmes must include evaluation of the oral health status of the institutionalised residents, oral health education tailored towards the integral role caregivers play in heeding to the special oral health needs of residents, and planning of oral hygiene practices for the residents, so as to meet the basic criteria for prevention of oral diseases and appropriate management thereof.[10]

STUDY LIMITATIONS

Due to the Covid-19 pandemic and the subsequent regulations on lockdown, the number of participating LTC facilities were limited to seven n=7 from a total sample of n=67. Access to study sites was prohibited to visitors, including the researcher, which resulted in a delay of the data collection. The use of self-reported questionnaires may have resulted in over or underreporting by reason of social desirability, thereby not necessarily demonstrating the current situation[35,36] The study was limited to the eThekwini district and cannot be generalised to other regions of KwaZulu-Natal. Further research on a larger scale is required to explore the effect of an oral health education intervention on the oral health related knowledge, attitudes and practices of caregivers at long-term care facilities in South Africa.

RECOMMENDATIONS

The results of this study can be used to make recommendations to oral health planners and stakeholders to develop clear and comprehensive oral health policies within LTC facilities, and on a national level. More emphasis needs to be placed on oral health promotion during the planning process of oral health policies to address the special needs of individuals residing at LTC facilities. Additionally, the nursing curriculum should be more inclusive of oral health education to ensure better oral disease management and appropriate referral pathways are followed, thereby facilitating prompt treatment and improving overall quality of life among residents. Regular in-service oral health training can equip caregivers with the necessary knowledge and skills to provide preventive and promotional activities, such as oral screenings, to the residents under their care. Furthermore, a multidisciplinary and multisectoral approach can be formed with dental professionals, dental students and other healthcare professionals and sectors, to provide oral screenings to the residents as a means of increasing access and improving the oral and overall health of residents.[37]

CONCLUSION

The results of the study showed that there was an improvement in the oral health knowledge and attitudes among the caregivers in the post-intervention phase. The study revealed the importance and effectiveness of an oral health education intervention and therefore highlights the need for a scale up in oral health education and training at LTC facilities.

Conflict of interest

The authors declare they have no financial or personal relationships that may have inappropriately influenced them in writing this article. The authors consent to publication and declare there are no conflicting interests.

Funding

The authors received no financial support for the research, authorship and/or publication of this article.

Disclaimer

The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency of the authors.

REFERENCES

1. Khanagar S, Kini P, Kumar A, Rajanna V, Badiyani B, Jathanna V. Oral health care education and its effect on caregivers' knowledge, attitudes, and practices: A randomized controlled trial. J Int Soc Prev Community Dent [serial online]. 2014 [cited 2020 Nov 12];4(2):122. Available from: /pmc/articles/PMC4170545/?report=abstract. https://doi.org/10.4103/2231-0762.139843
2. World Health Organisation. Oral Health [Homepage on the internet]. 2022 [cited 2022 Jul 20]. Available from: https://www.who.int/news-room/fact-sheets/detail/oral-health
3. Abullais SS, Al-Shahrani FMF, Al-Gafel KMS, Saeed A-HA, Al-Mathami SA, Bhavikatti SK, *et al*. The knowledge, attitude and practices of the caregivers about oral health care at centers for intellectually disabled, in southern region of Saudi Arabia. Healthcare. 2020;8(4):416. https://doi.org/10.3390/healthcare8040416
4. Shah AF, Tangade P, Ravishan, Tirth A, Pal S, Manu B. Dental caries status of institutionalised orphan children from Jammu and Kashmir, India. Int J Clin Pediatr Dent. 2016;9(4):364–71. https://doi.org/10.5005/jp-journals-10005-1392
5. Nqcobo C, Ralephenya T, Kolisa YM, Esan T, Yengopal V. Caregivers' perceptions of the oral health related quality of life of children with special needs in Johannesburg, South Africa. Heal SA Gesondheid [serial online]. 2019 [cited 2020 Nov 12];24. Available from:/pmc/articles/PMC6917375/?report=abstract. https://doi.org/10.4102/hsag.v24i0.1056
6. Manchery N, Subbiah G, Nagappan N, Premnath P. Are oral health education for carers effective in the oral hygiene management of elderly with dementia? A systematic review. Dent Res J. 2020;17(1):1–9. PMID: 32055287
7. Simons D, Baker P, Jones B, Kidd EAM, Beighton D. An evaluation of an oral health training programme for carers of the elderly in residential homes. Br Dent J. 2000;188(4):206–10. https://doi.org/10.1038/sj.bdj.4800432
8. Gil-Montoya JA, de Mello ALF, Barrios R, Gonzalez-Moles MA, Bravo M. Oral health in the elderly patient and its impact on general well-being: A nonsystematic review. Clin Interv Aging [serial online]. 2015 [cited 2020 Oct 27];10:461–7. Available from: /pmc/articles/PMC4334280/?report=abstract. https://doi.org/10.2147/CIA.S54630
9. Hans R, Thomas S, Dagli R, Bhateja GA, Sharma A, Singh A. Oral health knowledge, attitude and practices of children and adolescents of orphanages in Jodhpur city Rajasthan, India. Journal Clin Diagnostic Res [serial online]. 2014;8(10):ZC22–5. Available from: https://doi.org/10.7860/JCDR/2014/9026.4948
10. Petrovski M, Terzieva-Petrovska O, Kovecevska I, Minovska A, Ivanovski K, Papakoca K. Oral health education of staff in long-term care institutions. Balk J Dent Med. 2019;23(2):63–7. https://doi.org/10.2478/bjdm-2019-0012
11. Hoad-Reddick G. Summary. Bristish Dent J. 1998;184:288.
12. Lago JD, Fais LMG, Montandon AAB, Pinelli LAP. Educational program in oral health for caregivers on the oral hygiene of dependent elders. Rev Odontol da UNESP [serial online]. 2017 [cited 2020 Nov 12];46(5):284–91. Available from: http://dx.doi.org/10.1590/1807-2577.23916
13. Wu SJ, Wang CC, Kuo SC, Shieh SH HY. Evaluation of an oral hygiene education program for staff providing long-term care services: A mixed methods study. Int J Environ Res Public Health. 2020;17:4429. https://doi.org/ 10.3390/ijerph17124429
14. Thema LK, Singh S. Integrated primary oral health services in South Africa: The role of the PHC nurse in providing oral health examination and education. African J Prim Health Care Fam Med. 2013;5(1):1–4. http://dx.doi.org/10.4102/phcfm.v5i1.413
15. Sampson P, Page C, Shepard G. Oral hygiene: the mouth trap. Nursing Times. 1987;19. PMID: 3299280.
16. Griffiths J, Boyle S. Oral assessment in color guide to holistic oral care: a practical approach. Mosby Year Book Europe Ltd; 1993. 87–98.
17. Hoad-Reddick G. Assessment of elderly people on entry to residential homes and continuing care arrangements. J Dent. 1992;20:199–201. http://doi.org/10.1016/0300-5712(92)90073-I
18. Thomas B, Ciliska D, Dobbins M, Micucci S. A process for systematically reviewing the literature: providing the research evidence for public health nursing interventions. Worldviews Evid Based Nurs. 2004;1:176–84. http://doi.org/10.1111/j.1524-475X.2004.04006.x
19. Senior service retirement places. Comprehensive directory of retirement facilities in South Africa [homepage on the internet]. 2021 [cited 2021 May 18]. Available from: https://www.seniorservice.co.za/advanced-search/?province=Kwa+Zulu+Natal&city=DURBAN+-+Greater+Durban&property_type=Old+Age+Homes&section=properties
20. eThekwini municipality. eThekwini municipality health and wellbeing service provider directory 2018 [homepage on the internet]. 2018 [cited 2021 May 19]. Available from: http://www.durban.gov.za/Documents/HWDirectory2018.pdf
21. Petersen PE, Yamamoto T. Improving the oral health of older people: the approach of the WHO global oral health programme. Community Dent Oral Epidemiol [serial online]. 2005 [cited 2020 Dec 2];33:81–92. Available from: https://www.who.int/oral_health/publications/orh_cdoe05_vol33.pdf. http://doi.org/10.1111/j.1600-0528.2004.00219.x
22. Stancic I, Popovac AJ, Vasovic M, Petrovic M. Caregivers' attitudes, knowledge and practices of oral care at nursing homes in Serbia. Mil Pharm Rev [serial online]. 2016 [cited 2020 Nov 12];73(00):65–65. Available from: https://www.researchgate.net/publication/301703786_Caregivers'_attitudes_knowledge_and_practices_of_oral_care_at_nursing_homes_in_Serbia. http://doi.org/ 10.2298/VSP141001065S
23. Urrutia C, Ormazábal F, Santander I, Salvo D. Oral health practices and beliefs among caregivers of the dependent elderly. Gerodontology. 2011;29(2):742–7. http://doi.org/10.1111/j.1741-2358.2011.00553.x
24. Cornejo-Ovalle M, Costa-de-Lima K, Pérez G, Borrell C, Casals-Peidro E. Oral health care activities performed by caregivers for institutionalised elderly in Barcelona-Spain. Med Oral Patol Oral Cir Bucal. 2013;18(4):e641–e649. http://doi.org/10.4317/medoral.18767
25. Walid E, Nasir F, Naidoo S. Oral health knowledge, attitudes and behavior among nursing staff in Lesotho. SADJ. 2004;59(7):288,290-92. PMID: 15537032.
26. Munoz N, Touger-Decker R, Byham-Gray L, Maillet J. Effect of an oral health assessment education program on nurses' knowledge and patient care practices in skilled nursing facilities. Spec Care Dent. 2009;29(4):179–85. http://doi.org/10.1111/j.1754-4505.2009.00084.x
27. Wong F, Yannies T, Leung W. Oral health and its associated factors among older institutionalised residents-a systematic review. Int J Env Res Public Heal. 2019;16(21):4132. http://doi.org/10.3390/ijerph16214132
28. Shah A, Naseem M, Khan M, Asiri F, AlQarni I, Gulzar S, *et al*. Oral health knowledge and attitude among caregivers of special needs patients at a comprehensive rehabilitation centre: an analytical study. Ann Stomatol. 2018;8(3):110–6. http://doi.org/10.11138/ads/2017.8.3.110
29. Liu HY, Chen JR, Hsiao SY, Huang S Te. Caregivers' oral health knowledge, attitude and behaviour toward their children with disabilities. J Dent Sci. 2017;12(4):388–95. http://doi.org/10.1016/j.jds.2017.05.003
30. Saarela RKT, Hiltunen K, Kautiainen H, Roitto HM, Mäntylä P PK. Oral hygiene and health-related quality of life in institutionalised older people. Eur Geriatr Med. 2022;13(1):213–20. http://doi.org/10.1007/s41999-021-00547-8
31. Manoharan S, Nagaraja V, Eslick G. Ill-fitting dentures and oral cancer: a meta-analysis. Oral Oncol. 2014;50(11):1058–61. http://doi.org/10.1016/j.oraloncology.2014.08.002
32. Khedekar M, Suresh K V, Parkar MI, Malik N, Patil S, Taur S, *et al*. Implementation of oral health education to orphan children. J Coll physicians Surg. 2015;25(12):856–9. PMID: 26691356.
33. Bushra R, Othman ZY. Initial impact of an educational programme for the orphans in Erbil city. Eurasian J Sci Eng. 2022;8(1):180–6.
34. Wardh I, Andersson L, Sorensen S. Staff attitudes to oral health care. A comparative study of registered nurses, nursing assistants and home care aides. Gerodontology. 1997;14:28–32. http://doi.org/10.1111/j.1741-2358.1997.00028.x
35. Ahamed S, Moyin S, Punathil S, Patil NA, Kale VT, Pawar G, *et al*. Evaluation of the oral health knowledge, attitude and behaviour of the preclinical and clinical dental students. J Int Oral Heal. 2015;7:65–70. PMID: 26124603.
36. Singh S, Pottapinjara S. Dental undergraduate students' knowledge, attitudes and practices in oral health self-care: A survey from a South African university. African J Heal Prof Educ. 2017;9(2):83–7. http://doi.org/10.7196/AJHPE.2017.v9i2.800
37. Thema LK, Singh S. Integrated primary oral health services in South Africa: The role of the PHC nurse in providing oral health examination and education. African J Prim Health Care Fam Med. 2013;5(1):1–4. http://dx.doi.org/10.4102/phcfm.v5i1.413

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.15054

The effect of COVID-19 lockdown on the epidemiology of maxillofacial trauma at tertiary health facilities in Pretoria

SADJ May 2023, Vol. 78 No.4 p196-199

N Khan[1], TK Madiba[2], B Xoki[3], WA Mjoli[4], T Nevhutalu[5]

ABSTRACT

Background

COVID-19 restrictions reduced the number of consultations of patients, including maxillofacial trauma patients.

Aim

To analyse and compare the epidemiology of maxillofacial trauma during the four months of the lockdown period (2020) and compare it with the same months from the previous year (2019).

Materials and method

A retrospective record-based study was conducted with data drawn from all maxillofacial trauma patients who presented in the maxillofacial and oral surgery unit of the University of Pretoria (UP) and Steve Biko Academic Hospital (SBAH) from April to July 2019 and April to July 2020. Data collected included age, gender, aetiology of injury, site of injury, severity and extent of injury, fracture pattern and site, waiting period for treatment and month of injury. A chi-square test was used to evaluate the association between variables. The level of significance was set at $p \leq 0.05$.

Results

A total of 197 patients with maxillofacial injuries were seen in the two institutions for the years 2019 and 2020, with ages ranging from 1 to 81 years and a median of 34.00. Most patients were males 167 (85%). Many patients were seen in 2019 at 139 (71%). There was no association between the fracture site and the aetiology. The mandible was significantly the most common site of injury and more conservative treatment was done as compared to other forms of treatment ($p < 0.05$).

Conclusion

More maxillofacial cases were seen in 2019 than in 2020 with more males as compared to females. Most injuries were assaults followed by motor vehicle accidents (MVA). The mandible was the common site of injury. More conservative treatment was done compared to other forms of treatment.

Keywords

Maxillofacial trauma, aetiology of injury, site of injury, fracture pattern and mode of treatment

Authors' information

1. Dr Nazia Khan, *BDS, MSc,* Department of Maxillofacial and Oral Surgery, School of Dentistry, University of Pretoria, Pretoria, South Africa. E: Nazia786092@gmail.com
   ORCID: 0000-0002-4110-6595
2. Prof Thomas K Madiba, *B.Dent Ther, BDS, DHSM, MChD* (Community Dentistry), Department of Community Dentistry, School of Dentistry, University of Pretoria, Pretoria, South Africa. E: thommy.madiba@up.ac.za
   ORCID: 0000-0002-0171-0595
3. Dr Buntu Xoki, *BChD, PGDip* (Oral Surgery), Department of Maxillofacial and Oral Surgery, School of Dentistry, University of Pretoria, Pretoria, South Africa. E: xoki.buntu@gmail.com
   ORCID:0009-0000-8428-5231
4. Dr WA Mjoli, *BDS, PGDip* (Oral Surgery), Department of Maxillofacial and Oral Surgery, School of Dentistry, University of Pretoria, Pretoria, South Africa
   ORCID:0009-0003-4335-6365
5. Dr T Nevhutalu, *BDS*, Department of Maxillofacial and Oral Surgery, School of Dentistry, University of Pretoria, Pretoria, South Africa
   ORCID: 0009-0003-4335-6365

Corresponding author:
Name: TK Madiba
Tel: +27 12 3192417
Email: thommy.madiba@gmail.com

Author's contribution:

N Khan	40%
TK Madiba	30%
B Xoki	10%
WA Mjoli	10%
T Nevhutalu	10%

INTRODUCTION

The use of the words "virus" and "maxillofacial trauma (MFT)" in the same sentence was previously unheard of. The recent outbreak of Severe Acute Respiratory Syndrome (SARS) Corona Virus 2 (Cov-2), which causes coronavirus disease 2019 (COVID-19), started in Wuhan City, in the Hubei Province of China. It has emerged as a global outbreak and a significant public health problem. On January 30 2020, the World Health Organization (WHO) declared COVID-19 a public health emergency of international concern[1]. To mitigate the spread of this disease, many countries were forced to introduce lockdowns, which came with several restrictions. Among the myriad restrictions in South Africa was the national curfew, which included limiting the movement of people out of their homesteads between the hours of 20:00 and 05:00, and banning of sale and use of alcohol and travelling. Furthermore, South Africa implemented a five-level COVID-19 alert system to manage the gradual easing of the lockdown. This risk-adjusted approach was guided by several criteria including levels of infections and rate of transmission, [capacity of health facilities, the extent of public health intervention and the social impact of continued restrictions. Alert level five started at midnight on March 26 2020 and, currently, South Africa is on adjusted level 1 as of October 1 2021[2].

Violence and injury are one of the quadruple burdens of disease in South Africa[3]; its continuous analysis is of vital importance to develop strategies for prevention. Injury surveillance of MFT in a Johannesburg hospital revealed that 30.1% of patients who presented in a Level 1 trauma tertiary hospital in Johannesburg had head and neck injuries[4]. Seventeen years later, a similar study revealed that only 19% had head and neck injuries[5].

The epidemiology of trauma reveals that assault-related maxillofacial fractures have become more frequent and are

https://doi.org/10.17159/sadj.v78i04.15054

the most important cause of facial fractures in industrialised countries[6]. In Europe, assaults represented the most frequent aetiology of MFT, with a rate of 39%. In some countries within Europe, assaults accounted for more than 60% of MFT[6], while in Canada and the US, assaults accounted for 73% and 37% respectively[7]. Almost all South African studies from 1960 and 2018 show a consistent pattern of interpersonal violence followed by MVA as the most common causes of maxillofacial fractures[8-11]. It has been suggested that a learned behaviour from political violence, with police playing a huge role, has been carried over to the new political dispensation as crime-related violence[3,11]. Some authors maintain that economic factors play a prominent role in interpersonal violence, but studies from other African countries that are poorer than South Africa show MVA is a major cause of facial fractures[12]. Studies on paediatric maxillofacial injuries (MFIs) show that road traffic accidents (RTA) are the most common cause of MFIs in South Africa[13-14].

A study in Pakistan with a sample size of 535 patients found that falling is the most common cause of maxillofacial fractures[15]. Another study reported that the incidence and aetiology of MFT are also affected by age-related activities[16]. The differences in the aetiology of MFT could be due to differences in social, cultural and environmental factors from one country to another[16].

Several studies report that alcohol use is increasingly becoming associated with MFT in Europe[6], with alcohol contributing to 70.8%, 59% and 65% of MFT cases in Germany, New Zealand[17] and South Africa[18] respectively. Also, a study from the Gulf Cooperation Council (GCC), a political and economic coalition made up of six countries – namely the Kingdom of Saudi Arabia, Bahrain, United Arab Emirates, Kuwait, Qatar and Oman – reported alcohol as a causative factor of most interpersonal violence. Restrictions of alcohol in Islamic states has resulted in a low incidence of MFT due interpersonal violence[19].

It has also been reported in the literature that MFT tends to occur in the evenings[7,20]. In South Africa, it has been observed that MFT is usually a result of interpersonal violence and many victims who are attacked in the evenings are unaware of the identity of their assailants[20].

The occurrence of MFT in the evenings and the association of MFT with alcohol consumption seems to contribute to the significant number of victims of MFT. An interesting dynamic about MFT among males in South Africa, however, is that when they do know the identity of their assailants, they are usually not related to them. This is in contrast to South Africa's female victims of MFT, who almost always know their assailants and describe them to be a partner or a former partner[20].

Maxillofacial injuries seem to be a disease of males worldwide, with males accounting for 79% of cases in Germany[21], 80.6% in New Zealand[17], 68% in the US[22] and 82% in South Africa[20]. This suggests that MFIs are an undeclared pandemic, especially among men under the influence of alcohol. The majority of urban MFI patients in the US were profiled as single (85%), males (75%) between the ages of 18 and 30 years (33%) and unemployed (45%)[23].

The South African lockdown period of 2020 included an Easter weekend. It has been seen in previous years that a large number of people travel by road across provinces or towns during this time and this results in an increased frequency of road traffic accidents (RTA), which are the second most common cause of MFT in South Africa[18,20]. One study shows that in the Gulf Cooperation Council, RTA is a chief reason of MFIs. This study concluded that the aetiology of MFI differs from developed countries to developing countries, where social violence is the leading cause in developed nations and traffic accidents are the chief cause in developing countries[19]. It would be of interest to analyse the impact of the lockdown on MFT, and quantify and compare the volumes of MFT during the Easter period in South Africa.

Some studies present the mandible as the most commonly affected bone[10], while others show that the nose was the most commonly affected bone[23]. Among paediatric patients, most fractures were those of the orbits, the frontal bone[13-14] and mandible[15].

Canada's maxillofacial injury mapping showed that rural counties had higher rates of MFI-related emergency department visits[7], while an American study revealed that maxillofacial injuries occur in urban settings[23]. The results of the North American studies differ from those of a South African study which did not show any statistically significant difference in maxillofacial injuries between rural and urban areas[20].

The lockdown period has provided us with a unique and rare opportunity to carry out studies and prove a number of issues that would not have been possible under normal circumstances, such as preventing access to alcohol and restricting interprovincial travel which both contribute to road traffic accidents. Anecdotal evidence suggests that during the lockdown there was a reduction in crime, MVAs and, subsequently, MFT casualties in tertiary hospitals. The purpose of this study was to compare MFT over four months (April to July) in 2019 and four months of lockdown (April to July) in 2020.

MATERIALS AND METHODS

Ethical approval was obtained from the Research Ethics Committee of the Faculty of Health Sciences, University of Pretoria (Ref: 844/2020). No personal details of the patients were disclosed and all information was strictly confidential and anonymous. A retrospective record-based study was conducted with data drawn from all maxillofacial trauma patients who presented in the maxillofacial and oral surgery unit of University of Pretoria (UP) at both Steve Biko Academic Hospital (SBAH) and the University of Pretoria Oral Health Centre, from April to July of 2019 and April to July of 2020.

Data taken from the files of the patients included age, gender, aetiology of injury, site of injury, severity and extent of injury (fracture/soft tissue/dental), fracture pattern and site, waiting period for treatment (time between injury and treatment) and month of injury.

Data was analysed with SPSS software (version 28; IBM, Somers, NY). Quantitative variables were summarised as proportions, frequencies, mean with their standard deviations, range and percentages. A chi-square test was used to evaluate the association between variables – age, gender, aetiology of injury, site of injury, severity and extent of injury (fracture/soft tissue/dental), fracture pattern and site. Level of significant was set at $P \leq 0.05$.

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.15054

Table 1. Year, month and aetiology of the maxillofacial injury n=197

Year n (%)	Gender n (%)	Month n (%)	Aetiology n (%)	Total
2019 139 (86)9	Female 20 (14)	April 49 (35.3)	Assault 71 (51.1)	139 (86)
	Male 119 (86%)	May 38 (27.3)	Fall 15 (10.8)	
		June 14 (10.1)	GSW* 4 (2.9)	
		July 38 (27.3)	MVA* 32 (23)	
			PVA 7* (5)	
			OTHER 10 (7.20)	
2020 58 (14)	Female 10 (17.2)	April 9 (15.5)	Assault 39 (67.2)	58 (14)
	Male 48 (82.8%)	May 9 (15.5)	Fall 6 (10.3)	
		June 19 (32.8)	GSW* 1 (1.7)	
		July 21 (36.2)	MVA* 6 (10.3)	
			PVA* 1 (1.7)	
			OTHER 5 (8.6)	
Total				**197 (100)**

*GSW (gunshot wound), *MVA (motor vehicle accident), *PVA (pedestrian vehicle accident)

RESULTS

A total of 197 patients with maxillofacial injuries were seen in the two institutions for the years 2019 and 2020 with ages ranging from 1 to 81 years and a median of 34.00, suggesting that the majority of the patients were in the range of 34 years of age. The majority of patients were males 167 (85%). The majority of patients were seen in 2019 at 139 (71%). The rest of the demographics can be seen in Table 1.

Table 1 indicates that the majority of maxillofacial consultations were because of assault cases which were almost two thirds in both years followed by motor vehicle accidents. In both years, more than 80% of the patients were males. Most of the patients were seen in 2019 with a significant decrease in numbers in 2020. Table 2 below depicts the fracture sites and the treatment done on the patients.

As far as treatment is concerned, significantly more treatments were done on the mandible with significantly more conservative treatment (CON) done followed by ORIF and closed reductions p=001. As far as the site of injuries is concerned, significantly more injuries were reported in the mandible as compared to the other sites p=0.001, see Table 3. Association between fracture site and aetiology of the injury can be seen in table 4 below.

When an association between the fracture site and aetiology was done it was found that there was no association p> 0.005. Although no association was observed it was found that assault cases were in the majority followed by motor vehicle accidents, with falls following closely. When association between gender and maxillofacial injuries and treatment were done it was found that there was no association between the variables p>0.005; this was even though significantly more males consulted as opposed to females.

DISCUSSION

Significantly more maxillofacial injury patients consulted in 2019 as compared to 2020 (139 versus 58) and this showed the effect of COVID-19 as the impact was only felt in 2020, when there were restrictions. The restrictions included that only emergencies to relieve pain and sepsis and that meant patients whose injuries did not seem to be emergencies could be postponed. For admissions patients had to provide a negative COVID test, which could also have contributed to low numbers during the COVID-19 era.

The majority of patients with maxillofacial injuries in this study were male and this agrees with several studies worldwide.[17,21&22]. A South African study conducted in 2018 also found that 82% percent of maxillofacial injuries were from males, and this is in line with the present study[20]. The influence of maxillofacial injuries was found to be related to alcohol in other studies, but this was not investigated in this study due to the alcohol ban during the COVID-19 lockdown in South Africa.

Table 2. Fracture and the type of treatment offered to patients n=197

Year n (%)	Fracture site n (%)	Treatment n (%)	Total
2019 139 (86)	Mandible 105 (76.3)	Closed 38 (27.3)	139 (86)
	Midface 23 (16.5)	CON* 65 (46.8)	
	Nil 10 (7.2)	ORIF* 35 (25.5)	
		RECON 1 (0.7)	
2020 58 (14)	Mandible 33 (56.9)	Closed 15 (25.9)	58 (14)
	Midface 19 (32.8)	CON* 22 (37.9)	
	Nil 5 (8.6)	ORIF* 19 (32.8)	
	Upper face 1 (1.7)	RECON* 1 (1.7)	
		RHT* 1 (1.7)	
Total			**197 (100)**

*CRF (closed reduction and fixation), *CON (conservative treatment), *ORIF (open reduction and internal fixation), *RECON (reconstruction)*, RHT (refusal of hospital treatment)

Table 3. Association between fracture site and treatment n=197

Fracture site	Treatment						p value
	CRF*	CON*	ORIF*	RECON*	RHT*	Total	0.001
Mandible	47	42	49	1	0	139	
MID	6	29	5	1	1	42	
NIL	0	15	0	0	0	15	
UPP	0	1	0	0	0	1	
Total	**53**	**87**	**54**	**2**	**1**	**197**	

*CRF (closed reduction and fixation), *CON (conservative treatment), *ORIF (open reduction and internal fixation), *RECON (reconstruction)*, RHT (refusal of hospital treatment)

The epidemiology of maxillofacial injuries in this study was found to be in the majority from assaults, followed by motor vehicle injuries. This is in line with studies done in industrialised countries like Europe, Canada and the US[6,7]. Almost all South African studies from 1960 and 2018 show a consistent pattern of interpersonal violence followed by motor vehicle accidents as the most common causes of maxillofacial fractures[8-10] and the present study is in line with the past studies. In the present study assaults far exceeds motor vehicle injuries and it makes sense as the lockdown restricted movement but allowed families to be together.

The present study indicated that more than half of the injuries involved the mandible followed by the midface and this is in line with other studies which indicated the mandible as the common site for injuries[10].

CONCLUSION

There were more maxillofacial consultations in 2019 than 2020 due to the COVID regulations. Significantly more males had maxillofacial injuries as compared to females. Most injuries were due to assault followed by motor vehicle accidents with the mandible being the most common site of injury. As far as treatment was concerned, more conservative treatment was done as opposed to other forms of treatments.

Limitations

This study is limited by the cross-sectional study design, and causality cannot be inferred. Despite the limitations, the current study provided useful information that may inform future studies in the institutions. It is recommended another study be done that will have a longitudinal design to understand the association of variables on a larger scale.

Conflict of interest

The authors declare there are no conflicts of interest.

REFERENCES

1. Meng L, Hua F, Bian Z. Coronavirus disease 2019 (Covid-19): Emerging and future challenges for dental and oral medicine. Journal of Dental Research. 2020; 99(5):481-7
2. www.gov.za (n.d.). About alert system | South African Government. [online] Available at:https://www.gov.za/covid-19/about/about-alert-system#:~:text=The%20country%20was%20on%20adjusted%20alert%20level%201%20from%201 [Accessed 2 May 2023]
3. Norman R, Matzopoulos R, Groenewald P, Bradshaw D. The high burden of injuries in South Africa. Bulletin of the World Health Organization. 2007; 85:695-702
4. Bruce JC, Schmollgruber S, Eales J, Gassiep J, Doubell V. Injury surveillance at a level 1 trauma centre in Johannesburg, South Africa. Health sa gesondheid. 2003; 8(3):3-12
5. Khan¹ N, Mabongo M, Kolisa Y. Injury survey at Chris Hani Baragwanath Academic Hospital, Soweto, South Africa. 2020
6. Boffano P, Roccia F, Zavattero E, Dediol E, Uglešic V, Kovacic Ž, *et al*. Assault-related maxillofacial injuries: The results from the European Maxillofacial Trauma (Eurmat) multicenter and prospective collaboration. Oral surgery, oral medicine, oral pathology and oral radiology. 2015; 119(4):385-91
7. Al-Dajani M, Quiñonez C, Macpherson AK, Clokie C, Azarpazhooh A. Epidemiology of maxillofacial injuries in Ontario, Canada. Journal of Oral and Maxillofacial Surgery. 2015; 73(4):693. e1-. e9
8. Beaumont E, Lownie J, Cleaton-Jones F, Neetyon N. An analysis of fractures of the facial skeleton in three populations in the Johannesburg urban area. The Journal of the Dental Association of South Africa = Die Tydskrif van die Tandheelkundige Vereniging van Suid-Afrika. 1985; 40(11):633-8
9. Bloch C, Strover R. Facial fractures: A brief survey. South African Medical Journal. 1969; 43(4):92-3
10. Pillay L, Mabongo M, Buch B. Prevalence and aetiological factors of maxillofacial trauma in a rural district hospital in the Eastern Cape. South African Dental Journal. 2018; 73(5):348-53
11. Chamisa I. Civilian abdominal gunshot wounds in Durban, South Africa: A prospective study of 78 cases. The Annals of The Royal College of Surgeons of England. 2008; 90(7):581-6
12. Obimakinde OS, Ogundipe KO, Rabiu TB, Okoje VN. Maxillofacial fractures in a budding teaching hospital: A study of pattern of presentation and care. The Pan African Medical Journal. 2017; 26
13. Van As A, Van Loghem A, Biermans B, Douglas T, Wieselthaler N, Naidoo S. Causes and distribution of facial fractures in a group of South African children and the value of computed tomography in their assessment. International Journal of Oral and Maxillofacial Surgery. 2006; 35(10):903-6
14. Fouche G, Mabongo M. The epidemiology and management of traumatic facial fractures in children seen in a tertiary hospital in Johannesburg, South Africa. South African Dental Journal. 2019; 74(7):358-63
15. Khan S, Khan Z, Hanif S, Riaz N, Warraich R. Patterns of facial fractures in children. British Journal of Oral and Maxillofacial Surgery. 2019; 57(10):1009-13
16. Zimmermann C, Troulis M, Kaban L. Pediatric facial fractures: Recent advances in prevention, diagnosis and management. International Journal of Oral and Maxillofacial Surgery. 2005; 34(8):823-33
17. Lee K. Global trends in maxillofacial fractures. Craniomaxillofacial trauma & reconstruction. 2012; 5(4):213-22
18. Desai J, Lownie J, Cleaton-Jones P. Prospective audit of mandibular fractures at the Charlotte Maxeke Johannesburg Academic Hospital. South African Journal of Surgery. 2010; 48(4):122-6
19. Al-Qahtani F, Bishawi K, Jaber M, Thomas S. Maxillofacial trauma in the Gulf countries: A systematic review. European Journal of Trauma and Emergency Surgery. 2021; 47(2):397-406
20. Mogajane B, Mabongo M. Epidemiology of maxillofacial fractures at two maxillofacial units in South Africa. South African Dental Journal. 2018; 73(3):132-6
21. Schneider D, Kämmerer PW, Schön G, Dinu C, Radloff S, Bschorer R. Etiology and injury patterns of maxillofacial fractures from the years 2010 to 2013 in Mecklenburg-Western Pomerania, Germany: A retrospective study of 409 patients. Journal of Cranio-Maxillofacial Surgery. 2015; 43(10):1948-51
22. Allareddy V, Allareddy V, Nalliah RP. Epidemiology of facial fracture injuries. Journal of Oral and Maxillofacial Surgery. 2011; 69(10):2613-8
23. Cohn JE, Smith KC, Licata JJ, Michael A, Zwillenberg S, Burroughs T, *et al*. Comparing urban maxillofacial trauma patterns to the National Trauma Data Bank©. Annals of Otology, Rhinology & Laryngology. 2020; 129(2):149-5

Table 4. Association between fracture site and aetiology of the injury n=197

Fracture site	AETIOLOGY						Total	p value
	Assault	Fall	GSW*	MVA*	PVA*	Other		0.96
Mandible	77	15	4	29	5	9	139	
Midface	23	3	1	7	3	5	42	
NIL	9	3	0	2	0	1	15	
Upper face	1	0	0	0	0	0	1	
Total	**110**	**21**	**5**	**38**	**8**	**15**	**197**	

*GSW (gunshot wound), *MVA (motor vehicle accident), *PVA (pedestrian vehicle accident)

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.15782

The dental management of patients with recessive dystrophic epidermolysis bullosa: a case report of two siblings

SADJ May 2023, Vol. 78 No.4 p200-206

J Fourie[1], I Middleton[2], T Dippenaar[3]

ABSTRACT

Introduction

Epidermolysis bullosa (EB) is a group of rare inherited disorders uniquely characterised by skin and, in some instances, mucosal blistering. In the most severe form of the disease, recessive dystrophic EB (RDEB), the blister-inducing split occurs below the lamina densa. Extensive scarring of the oral mucosa results in limited mouth opening, making speech and mastication difficult. At the same time, oral mucosal blisters often lead to patients restricting their diets to soft, and generally cariogenic, foods, and battling with oral hygiene practices. This results in poor plaque control, a high caries burden and complex dental management.

Aims and objectives

This paper presents a report on two siblings suffering from generalised RDEB affecting the oral cavity and their extensive dental treatment needs.

Design/Methods

The siblings were referred to the University of Pretoria Oral Health Centre, complaining of painful teeth and oral mucosal discomfort. Their clinical features, dental condition and subsequent management are presented.

Results

Restricted mouth opening, limited personal plaque control and diets limited to soft, carbohydrate-rich foods because of oral mucosal discomfort, resulted in extensive dental decay that required multiple extractions.

Conclusion

The dental and anaesthetic management of patients with RDEB is complex and, due to the friable tissues, requires the most atraumatic care possible. Ideally, patients with this condition need to have early dental intervention where preventive programmes can be implemented to reduce the need for later extensive and complicated dental interventions. Maintenance of the patient's oral health is essential to ensure adequate nutrition, yet also reducing the consumption of soft cariogenic diets which increased their caries risk.

Keywords

Recessive dystrophic epidermolysis bullosa, dental management, general anaesthetic, oral features

Abbreviations

EB: epidermolysis bullosa
DEB: dystrophic epidermolysis bullosa
RDEB: recessive dystrophic epidermolysis bullosa
DDEB: dominant dystrophic epidermolysis bullosa
JEB: junctional epidermolysis bullosa
IFM: immunofluorescence mapping
TEM: transmission electron microscopy
SCC: squamous cell carcinoma
UPOHC: University of Pretoria Oral Health Centre
LA: local anaesthesia
GA: general anaesthesia

Authors' information:

1. Dr Jeanine Fourie. Department of Periodontics and Oral Medicine, School of Dentistry, Faculty of Health Sciences, University of Pretoria
   Tel: +27 12 3192312. Email: jeanine.fourie@up.ac.za
   ORCID: 0000-0002-8674-8145
2. Dr Illana Middleton. Department of Odontology, School of Dentistry, Faculty of Health Sciences, University of Pretoria
   Tel: +27 12 319-2434. Email: ilana.middleton@up.ac.za
   ORCID: 0000-0002-4279-0659
3. Prof Tinus Dippenaar. Principal Specialist, Head Clinical Unit: Anaesthesiology, Dept Maxillo-Facial-Oral Surgery, UPOHC
   Tel: +27 12 319 2385. Email: tinus.dippenaar@up.ac.za
   ORCID: 0000-0002-2338-2975

Corresponding Author

Name: Dr Jeanine Fourie.
Tel: +27 12 3192312.
Email: jeanine.fourie@up.ac.za

Authors' contribution:

1. J Fourie 70%
   Review of disease pathogenesis, dental and mucosal treatment
2. I Middleton 10%
   Discussion of dental treatment challenges
3. T Dippenaar 20%
   Discussion of anaesthetic challenges

INTRODUCTION

Epidermolysis bullosa (EB) is a group of rare disorders uniquely characterised by skin and, in some instances, mucosal blistering. Three main types have been identified based on the level of the epidermis at which the blisters and/or splits develop, namely intra-epidermal (Simplex EB), intra-lamina lucida (Junctional EB) or sub-lamina densa (Dystrophic EB). There is a further subcategory which presents with mixed splits as seen in patients with Kindler syndrome.[1-3] The diagnosis is determined using transmission electron microscopic (TEM) findings and immunofluorescence mapping (IFM). Further testing with monoclonal antibodies directed against components of the skin and basement membrane zone can be used to subclassify the disease and establish which structural protein is mutated.[1-2] This latter mutational analysis allows the most precise subclassification.[2] Each of these inherited disorders is associated with a particular genetic mutation and subsequent altered production of a key structural protein of the epidermis. In RDEB, mutation of *COL7A1* results in defective production of collagen type VII.[1,3]

This paper presents case reports, and the subsequent dental management, of two siblings with dystrophic epidermolysis

https://doi.org/10.17159/sadj.v78i04.15782

bullosa (DEB). This disease can be categorised as dominant (DDEB) or recessive (RDEB) according to the inheritance pattern, while the extent of skin involvement determines if it is generalised or localised.[1] The recessive subtype presents clinically more severely than the dominant subtype, due to the amount and functionality of the anchoring fibril protein that is affected.[4]

The prevalence of DEB and its clinical varieties has not been established in South Africa, but comprehensive registries have been created in Scotland and The Netherlands.[5-6] The overall prevalence of DEB in Scotland is 24/million, with 68% of cases transmitted dominantly, 13% recessively, and the remainder is undetermined.[5]

In the Dutch registry, DEB was the second most common variety of EB (37%), after epidermolysis bullosa simplex (45.7%). The annual incidence of DEB in this population is reported to be 14.1 per million live births, and the point prevalence is 8.3 per million of the population. Dominant DEB (67.1%) appears more frequently than RDEB (32.9%). The latter is strongly correlated with parental consanguinity.[6] While both of these registers have been made possible by the countries having robust healthcare systems, the Dutch register is further benefited by well-characterised molecular diagnoses and confirmation in 90% of the cases.[6]

CASE PRESENTATION

Permission was obtained from the University of Pretoria, Faculty of Health Sciences, Research Ethics Committee clearance number 750 2022, following informed consent of the participants.

Case 1

A 14-year-old boy was referred to the Oral Medicine clinic at the University of Pretoria Oral Health Centre (UPOHC) with a diagnosis of DEB. His dentist has asked for help with his complex dental needs and treatment. His condition was diagnosed clinically, at birth, based on the fact that his older sister suffered from the same condition. No special investigations had ever been performed. His affected skin areas were treated with silbecor dressings (silver sulfadiazine). The patient was otherwise healthy, had no allergies and on no medication except for a daily multivitamin supplement.

His oral hygiene practices had been severely limited due to the extreme fragility of the oral mucosa, and pain when brushing. He had only been rinsing with a 0.2% chlorhexidine formulation as prescribed by his dentist. His diet was restricted to soft foods and liquids which may have limited its variety and nutritional value. His small stature was a further suggestion of likely malnourishment.

Figure 1: Scarring and crusting of the patient's skin.

The visual extra-oral examination revealed both current blisters as well as evidence of past lesions which had resulted in scarring (Figure 1) and a 'mitten hand' deformity (pseudosyndactyly) in both hands (Figure 2). The skin lesions were accompanied by pruritus. Oral and peri-oral examination revealed limited mouth opening (Figure 3) and mucosal fragility, both of which prevented the clinician from performing a detailed intra-oral examination. He had numerous broken down teeth that may have aggravated the oral blisters, causing even more soft tissue damage and pain. He was unable to protrude his tongue due to scarring. Dental crowding of the anterior maxilla was also noted.

Intra-oral dental radiographs could not be obtained due to his microstomia and ankyloglossia.[7] A panoramic radiograph revealed extensive caries (Figure 4), which would require extraction of teeth 36, 46, 26, 16, 21, and root rests of 14 and 63. This was carried out under general anaesthesia (GA) where it was hoped that the amount of soft tissue damage and pain could be managed better. Access and vision during the surgery was complicated by the severe microstomia, which also prohibited use of standard lip and cheek retractors. The commissures of the lip were protected with petroleum jelly, and dental extractions were performed carefully using dental forceps where possible and elevators in the more posterior areas. Despite all attempts to limit mucosal trauma, sheets of epithelium detached during the procedure (Figure 5). This complication has been reported by others and was anticipated.[7] A hydrocortisone ointment (1g/100g) was prescribed to reduce mucosal inflammation,

Figure 2: Pseudosyndactyly of the patient's right hand.

Figure 3: Microstomia, dental crowding and decay that is visible of the anterior maxillary teeth.

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.15782

Figure 4: Pre-operative panoramic radiographic image (above).
Figure 5: Mucosal detachment during dental treatment (right).

as well as a combined suspension of paracetamol (250mg), ibuprofen (200mg) and codeine phosphate (10mg/10ml), taken as 10ml every 4-6 hours for postoperative pain control.

Prophylaxis and desired maintenance of the patient's remaining dentition will rely on chemical plaque control, through the use of a 0.12% chlorhexidine mouthwash with cetylpyridinium chloride in an aqueous solution, and fluoridated toothpaste which he can rub onto the tooth surfaces. However, the mechanical plaque control shall be limited due to the fragility of the oral mucosa and his inability to hold a toothbrush. He was also given a sucralfate (1g/5ml) suspension to apply when new blisters develop, and topical glucocorticoid syrup (betamethasone 0.6mg/5ml) which can be used in a diluted form as a mouth rinse to help reduce inflammation.

Case 2

The patient's older sister also then came for dental treatment. She presented with a similar clinical picture as her brother (Figure 6, Figure 7, Figure 8) and used the same therapy for her skin lesions. She also had no other diseases, allergies or habits of relevance.

A panoramic radiograph revealed extensive caries, which necessitated the removal of teeth 13, 14, 15, 37, 36, 46, 23, 24, 25 and 26 (Figure 9). There was also evidence of a dental abscess on the 37. Unfortunately, the long theatre waiting list prevented immediate dental treatment, necessitating the need for antibiotics to manage the existing dental abscess. The extent of debilitation associated with this condition became starkly evident as she was unable to swallow tablets due to oesophageal stenosis, and required suspension formulations.[7] During the consultation, the patient had high aesthetic desires and requested to have her teeth restored with aesthetic crowns and veneers.

Figure 6: Extra-oral appearance demonstrating microstomia.

Figure 7: Limited intra-oral appearance demonstrating mucosal ulceration.

Figure 8: Pseudosyndactyly of the patient's hand (above).
Figure 9: Pre-operative panoramic radiographic image (right).

https://doi.org/10.17159/sadj.v78i04.15782

Unfortunately, given access limitations, badly broken down dentition, and questionable future oral hygiene maintenance that this disease imposes, this was not possible.

She was given a similar maintenance and therapeutic programme as her brother.

DISCUSSION

Diagnosis

Both patients were diagnosed with RDEB, based on the fact that neither parent had evidence of the disease, yet both siblings suffered from the disease. The diagnosis was largely based on the clinical history, including the age at the time of the onset of the bullae, the distribution of the lesions and eliciting factors of bullae formation.[2]

Ideally, the diagnosis should be confirmed through TEM, and/or IFM, and/or genetic testing (mutation analysis) of the patients and parents to type and subtype the EB variant.[2,6,9] However, the literature reports on many cases diagnosed purely on clinical features, with less than 20% confirmed by molecular analysis.[9]

Given the longstanding nature of the presumed diagnosis and dermatological care that the patients have received, it was not considered necessary to subject the patients to further special investigations.

Clinical features

The RDEB variants usually have an onset at birth where patients present with generalised skin involvement. These are characterised by blisters, milia, atrophic scarring, dystrophic or absent nails, pseudosyndactyly and scalp abnormalities.[1,10] Blisters are easily induced, and may also involve the mucosa of the oral cavity, eyes and gastrointestinal tract where recurrent blisters and healing result in scarring. In addition, patients may also suffer from anaemia and growth retardation with a significant risk of squamous cell carcinoma (SCC) by the age of 30.[1]

Blisters may also affect any oral mucosal surface, and although they may be common to all EB subtypes, they are more severe in RDEB,[11] occurring in 92% of patients, and most frequently affecting the tongue.[12] In neonates, blisters may interfere with the child's ability to suckle.[4] Pacifiers can also induce blistering and parents should be advised to avoid using them.[13]

The continuous process of blister formation, healing and scarring leads to changes in the oral architecture with loss of the buccal vestibule, palatal rugae and tongue papillae. The tongue frequently becomes bound down to the floor of the mouth (ankyloglossia) and mouth opening becomes incrementally more restricted (microstomia).[4,8,11-15] Microstomia is severe (<30mm interincisal distance) in 80% of patients.[12] These oral features are unique to RDEB, and are not seen in the other inherited EB varients.[11] Lack of tongue papillae is thought to be due to the severity and duration of the disease,[8,14] but may also serve as a sensitive (87%) predictor of RDEB-generalised-severe at birth.[16] Caries and dental crowding are frequent findings,[7] yet, unlike other forms of EB, enamel hypoplasia is not present.[1]

Lesions that are more commonly found on the skin may also be found intra-orally, such as milia (keratocysts) and squamous cell carcinoma (SCC).[4,9,12] Oral SCC development is most likely due to chronic inflammation, especially in the absence of other known risk factors.[9]

Pathogenesis of skin disease and mucosal blistering

Mutations that result in loss of function in the *COL7A1* gene result in abnormal or absent collagen type VII protein synthesis. This protein is normally produced by keratinocytes and fibroblasts, and is instrumental in anchoring the epidermal basement membrane to the dermis. Thus, abnormalities in these anchoring fibrils result in blister formation.[10,17-18] The mutation of *COL7A1* can occur along any of the 118 exons, but several hotspot mutations are associated with particular ethnic groups.[18]

Repeated blistering leads to protracted wound healing, especially at sites that are routinely exposed to mechanical stress. The near-continuous cycles of blistering and altered healing result in persistent ulceration that is characterised by incomplete epithelialisation, frequent infections and perilesional inflammation which eventually results in chronic ulcers with fibrosis and scarring. The sequela of these events are seen as syndactyly, mitten deformities and limb ankylosis, oesophageal strictures and multiple SCCs of the skin.[17]

A multistage pathogenesis of skin disease is proposed in RDEB and is defined by defects in the inflammatory response, skin proliferation and skin remodelling. Fibrosis predominates during healing due to persistent inflammation, reduced myofibroblast removal and excessive ECM deposition, and ultimately results in hand and foot deformities as well as aggressive SCC.[17,19] Fibrosis creates a permissive tumour microenvironment, with fibroblasts adapting a carcinoma-associated fibroblast behaviour, being able to promote the development of cancer themselves.[19] IL-6, an inflammatory cytokine responsible for fibrosis, which directly correlates with the severity of the disease, also regulates the growth and metastatic behaviour of epithelial malignancies.[19] The absence of COL7 enhances epithelial migration, invasion and vascularisation, and impairs epithelial differentiation, resulting in aggressive malignant behaviour.[20]

Early detection is a clinical and histologic challenge because SCC occurs within chronic wounds and scars, where it is hard to distinguish it from granulation tissue and other reactive changes.[19] Subsequently, cutaneous SCC has a very poor prognosis in DEB and represents the first cause of death in these patients.[6,19]

Although cutaneous SCC may also occur among other EB subtypes, the majority (69.2%) is found among patients with RDEB, where the median age of diagnosis is 36 years, and results in death in 41% of patients.[9] The majority of SCC develop on the upper and lower extremities, particularly over bony prominences, and typically (99% frequency) in areas of chronic non-healing ulcerations, and only unusually appears on sun-exposed skin. Aggressive surgery, including partial limb amputation, may be supplemented with chemo- and/or radiation therapy, but radiation therapy toxicity and low skin tolerance limits its use. Relapse is common (36.1%) due to the difficulty of establishing tumour margins in the altered field.[9]

Oral mucosal treatment considerations

RDEB present with the most extensive oral mucosal involvement among the EB subtypes, characterised by

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.15782

blistering, erosions and scarring,[11] yet the treatment of these oral lesions has seldom been reported. Individual reports were found to support the use of sucralfate, low-level laser therapy (LLLT) with cord blood platelet gel, and gentamycin,[15,21-23] and, most recently, stem cell therapy.[24] Effective treatment of oral mucosal lesions is necessary to improve plaque control, and therefore reduce caries experience and gingival inflammation, as well as to improve nutrition.

The topical use of sucralfate was shown to relieve pain and reduce the number of oral blisters experienced by DEB patients. Sucralfate creates a viscous, adhesive coagulum to coat areas of damaged mucosa, effectively providing protection against local irritants such as toothpaste, toothbrush and food, favouring the re-epithelialisation of the ulcer bed. Hopefully, by reducing the number and size of oral blisters, scarring and the resultant microstomia and ankyloglossia can also be prevented.[15,21] Sucralfate may also be compounded with diphenhydramine hydrochloride and lidocaine, which is commonly known as magic mouthwash, to manage oral discomfort.[8]

Sindici *et al*., 2016 used cord blood platelet gel in combination with LLLT in the treatment of persistent oral ulcers in seven patients with DEB, resulting in the healing of lesions. However, lesions recurred shortly thereafter and continued to develop over untreated surface areas. Admittedly, the combined treatment protocol does not allow us to measure the individual treatment effects, and either one of these therapies may have been effective.[22]
A twice-daily oral rinse with 0.3% gentamycin resulted in clinical and symptomatic improvement with healing of oral lesions and a reduced number of new blisters. The authors propose that topical gentamycin effectively treats skin wounds because of its antiseptic activity and by repairing the nonsense mutation so that the collagen type VII protein is fully synthesised.[23]

More recently, attention has turned towards correcting the gene defect responsible for the disease. Regenerative treatment approaches include stem cell therapy and gene therapy.[24]

A functional copy of the affected gene can be added through retroviral and lentiviral vectors to epidermal keratinocytes and fibroblasts to transduce and correct the keratinocytes of RDEB patients. The transgenic keratinocytes are then used to generate autologous epidermal sheets which are grafted onto patients.[17-18,24]

Stem cell therapy, of mesenchymal and hematopoietic origin, results in improved healing of chronic wounds and decreased mucocutaneous blister formation. But the required myeloablative conditioning treatment is associated with significant risks, limiting this treatment strategy.[17-18,24]

Alternatively, bone-marrow mesenchymal stromal cells may be used to improve wound repair and tissue regeneration by promoting healing, secreting structural proteins (collagen III, VII and XVII) and reinforcing the basement membrane zone to improve re-epithelialisation. However, clinical benefit is short-lived due to donor cell exhaustion.[17-18,24]

And lastly, gene editing is being explored to reprogramme the mutated *COL7A1* gene in induced pluripotent stem cells from patients with RDEB into functional hematopoietic cells.[17-18,24]

Dental disease

Children with RDEB tend to have more caries, gingivitis and higher plaque scores.[25] A study has shown that the prevalence of dental caries, scored as DMFS (decayed, missing, filled surfaces), was significantly higher in JEB (mean 58.6) and RDEB (mean 37.6) than in controls (mean 23.2).[11] This correlates with the enamel defects in JEB, but is not directly proportional to the degree of oral soft tissue involvement in RDEB, emphasising the multifactorial aetiology of caries.[11]

Unlike JEB, in which the enamel is structurally compromised, the tooth structure in RDEB is chemically and mechanically sound[11,25-26] because the *COL7A1* gene is not expressed by ameloblasts,[4] and the eruption and maturation patterns match healthy controls.[27] Neither can the caries be attributed to salivary gland dysfunction, as both flow rates and antibody titres are comparable with controls.[11] However, plaque control is complicated by a very small mouth opening,[28] painful blisters that develop upon the slightest mechanical trauma such as tooth brushing,[25,29] and a physical inability to hold a toothbrush.[8,25] Yet, tooth brushing is possible, and can be simplified with the following adaptations: using a small headed, soft bristle brush which may even be shortened; and adapting the handle to the hand impairment of the patient.[7] Others suggest the use of oral irrigators and a soft electric toothbrush.[8,14-15] Daily exercises can maintain, and hopefully improve, mouth opening.[7]

A soft, high carbohydrate diet may be favoured due to dysphagia from oesophageal strictures, the fragility of the oral mucosa, and to increase calorie intake.[5,8,25] Although total daily sugar intake may still be similar to healthy controls, it is possible that reduced oral clearance, and slow and frequent eating patterns, increase carbohydrate contact time and therefore caries risk.[4,11,25] Meals should be accompanied by fluids to improve oral clearance,[11] and dietary advice should be given.[7-8,15]

It is also likely that dental care may take a back seat due to the complexity of the medical condition,[13] the hesitancy by patients and caregivers to approach dentists, and dentists' reluctance to manage this rare disease.[7,28] Microstomia is the biggest obstacle in dental management, followed by ankyloglossia and the risk of trauma during dental procedures.[8,13-14,28]

Given these factors, it is essential that all possible attempts be made to preserve the dentition, with early referral to a multidisciplinary team and regular follow-up.[7,15,28] Preservation of the dentition is key to maintaining nutrition and improving aesthetics, self-esteem and phonetics.[7,28]
The tooth structure should be protected by systemic and topical fluoride applications, together with chemical plaque control,[28] as this combination can successfully maintain the dentition.[14] Neutral sodium fluoride applications,[11] as well as fluoride varnishes, may be used.[8,11,15]

Chlorhexidine (0.12% to 0.2%) solutions may be difficult to manipulate due to limited oral movement; therefore, the solution or gel can either be applied with a cotton bud,[8,13-14] or sprayed on the tooth surfaces.[25] In all cases, alcohol-free preparations should be used.[8,11]

https://doi.org/10.17159/sadj.v78i04.15782

In cases with extensive dental decay where extractions are needed, it may be better to perform them under GA.[29-30] However, routine dental treatment may be tolerated by some patients,[8] and even extractions may be performed under local anaesthesia (LA).[14] Clinicians should be aware that no sutures should be placed following dental extractions, unless absolutely necessary, and haemostasis is achieved with compression only.[7-8]

It may be possible to carry out endodontic therapy under LA up to the second premolar, by using short files, making use of a vestibular or palatal access cavity, an apex locator (to avoid using intra-oral radiographs) and using diluted 1% sodium hypochlorite due to the risk of mucosal injury.[28] The literature reports that root canal-treated teeth have been restored with prosthetic crowns,[28] and missing teeth have successfully been replaced with a removable partial denture.[14] However, impression-taking will be complicated by limited mouth opening and the fragility of the oral mucosa, and this may also complicate denture wearing.[7]

Special precautions should be taken during dental treatment, such as: covering all metal instruments and retractors with hydrocellular foam dressing and with soft silicone adhesive; liberally coating all mucosal surfaces and equipment with petroleum jelly or hydrocortisone ointment; always positioning the suction tip on a hard tooth surface; using paediatric size instruments and a laryngeal mirror; depositing LA deep to prevent separation of tissue layers; and moistening cotton rolls before use.[7,15,28-30] The fact that even topical anaesthetic application or the use of an air syringe can result in blistering explains why extensive sloughing of the skin and oral mucosa may be experienced despite these precautions being taken.[7-8,30] If bullae form, they should be drained to avoid further expansion.[7,28] Surprisingly, the healing of blisters and extraction sites is uneventful and remarkably painless.[8,14] Antibiotic cover has been suggested to prevent infection of ruptured bullae,[8,13] although this is not supported by evidence.[7]

Anaesthetic management

General anaesthesia is generally preferred in the dental management of patients with RDEB, [8,13,30] but is extremely challenging.[31] Some suggest that all mucosal surfaces and equipment used during induction and intubation be liberally coated with petroleum jelly.[15,29] Yet even this may be difficult to perform due to restricted access.

A further challenge in patients that are malnourished may be electrolyte abnormalities, hypoalbuminemia, deranged renal function and anaemia.[32] In addition, certain diseases associated with EB, such as porphyria cutanea tarda, diabetes mellitus, amyloidosis, multiple myeloma and hypercoagulable states, can impact GA. The clinician should also consider the pre-operative use and dosage of disease modifying drugs such as corticosteroids. Intra-operative corticosteroid replacement should be given in cases of steroid use within the last 12 months.

During examination of the airway, oral scarring or microstomia will indicate difficult passage of the laryngoscope during intubation. Scarring of the skin and the pseudosyndactyly will make placement of an intravenous cannula very challenging. With induction of anaesthesia the face mask should be applied with as little pressure as possible to prevent blister formation of the face. The use of an oro-pharyngeal airway to maintain patency during bag mask ventilation is discouraged due to risk of mucosal damage. Intubation (which may be complicated with bullae formation or bleeding into the airway) should be done with extreme caution as not to damage the friable mucosal surfaces. Since dental surgery requires nasal intubation, it is recommended that a preformed nasal endotracheal tube (north facing RAE) with the smallest circumference, but that still has adequate length, be used. Fortunately, the mucosa of the larynx is rarely involved, so endotracheal intubation is considered safe as long as the cuff of the tube is carefully inflated to provide just enough resistance to leakage during positive pressure ventilation.[33] The endotracheal tube is fixed so that there is no traction on the nostril through which it is placed. Over the course of the tube from the nose to the forehead, the skin under the tube must be protected by means of pressure absorbent material such as a small sponge. To prevent trauma or development of life threatening oro-pharyngeal bullae at extubation, the airway is suctioned under direct vision before careful removal of the endotracheal tube.

The application of any adhesive material, such as standard eye patches, adhesive ECG electrodes, transparent fixation material for IV cannulas and endotracheal tube fixation tape, will cause bullae formation, and as such must all be avoided.[31] IV cannula should rather be fixed by means of a gauze wrap or suture, while the endotracheal tube can be attached with a broad elastic material wrap around the head. Antibiotic eye ointment is placed in the eyes to prevent drying, rather than closing the lids with eye patches.

If needle ECG electrodes are not available, ECG is generally not monitored during the procedure, and pulse oximetry and capnography are used to monitor circulation. The non-invasive blood pressure cuff is applied to the selected limb only after loosely wrapping the area in orthopaedic wool to eliminate friction. The patient should be positioned on the table as to avoid any pressure-related bullae formation.

CONCLUSION

The dental and anaesthetic management of patients with RDEB is challenging, mostly due to the microstomia and mucosal fragility. Unfortunately, this population also often has extensive dental disease, due to their cariogenic diet, and frequently requires multiple dental extractions. This paper outlines strategies for prevention and treatment of oral disease and maintenance of the dentition in this vulnerable population.

REFERENCES

1. Fine JD, Eady RA, Bauer EA, Bauer JW, Bruckner-Tuderman L, Heagerty A, *et al*. The classification of inherited epidermolysis bullosa (eb): Report of the third international consensus meeting on diagnosis and classification of eb. J Am Acad Dermatol. 2008; 58(6):931-50. doi:10.1016/j.jaad.2008.02.004
2. Fine JD, Bruckner-Tuderman L, Eady RA, Bauer EA, Bauer JW, Has C, *et al*. Inherited epidermolysis bullosa: Updated recommendations on diagnosis and classification. J Am Acad Dermatol. 2014; 70(6):1103-26. doi:10.1016/j.jaad.2014.01.903
3. Has C, Bauer JW, Bodemer C, Bolling MC, Bruckner-Tuderman L, Diem A, *et al*. Consensus reclassification of inherited epidermolysis bullosa and other disorders with skin fragility. Br J Dermatol. 2020; 183(4):614-27. doi:10.1111/bjd.18921
4. Wright JT. Oral manifestations in the epidermolysis bullosa spectrum. Dermatol Clin. 2010; 28(1):159-64. doi:10.1016/j.det.2009.10.022
5. Horn HM, Tidman MJ. The clinical spectrum of dystrophic epidermolysis bullosa. Br J Dermatol. 2002; 146(2):267-74. doi:10.1046/j.1365-2133.2002.04607.x
6. Baardman R, Yenamandra VK, Duipmans JC, Pasmooij AMG, Jonkman MF, van den Akker PC, *et al*. Novel insights into the epidemiology of epidermolysis bullosa (eb) from the dutch eb registry: Eb more common than previously assumed? J Eur Acad Dermatol Venereol. 2021; 35(4):995-1006. doi:10.1111/jdv.17012
7. Krämer SM, Serrano MC, Zillmann G, Gálvez P, Araya I, Yanine N, *et al*. Oral health care for patients with epidermolysis bullosa–best clinical practice guidelines. Int J Paediatr Dent. 2012; 22 Suppl 1:1-35. doi:10.1111/j.1365-263X.2012.01247.x
8. Lindemeyer R, Wadenya R, Maxwell L. Dental and anaesthetic management of children with dystrophic epidermolysis bullosa. Int J Paediatr Dent. 2009; 19(2):127-

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.15782

34. doi:10.1111/j.1365-263X.2008.00940.x
9. Montaudié H, Chiaverini C, Sbidian E, Charlesworth A, Lacour JP. Inherited epidermolysis bullosa and squamous cell carcinoma: A systematic review of 117 cases. Orphanet J Rare Dis. 2016; 11(1):117. doi:10.1186/s13023-016-0489-9
10. Bruckner-Tuderman L. Dystrophic epidermolysis bullosa: Pathogenesis and clinical features. Dermatol Clin. 2010; 28(1):107-14. doi:10.1016/j.det.2009.10.020
11. Wright JT, Fine JD, Johnson L. Dental caries risk in hereditary epidermolysis bullosa. Pediatr Dent. 1994; 16(6):427-32.
12. Serrano-Martínez MC, Bagán JV, Silvestre FJ, Viguer MT. Oral lesions in recessive dystrophic epidermolysis bullosa. Oral Dis. 2003; 9(5):264-8. doi:10.1034/j.1601-0825.2003.03971.x
13. Hochberg MS, Vazquez-Santiago IA, Sher M. Epidermolysis bullosa. A case report. Oral Surg Oral Med Oral Pathol. 1993; 75(1):54-7. doi:10.1016/0030-4220(93)90406-t
14. Oliveira TM, Sakai VT, Candido LA, Silva SM, Machado MA. Clinical management for epidermolysis bullosa dystrophica. J Appl Oral Sci. 2008; 16(1):81-5. doi:10.1590/s1678-77572008000100016
15. Louloudiadis AK, Louloudiadis KA. Case report: Dystrophic epidermolysis bullosa: Dental management and oral health promotion. Eur Arch Paediatr Dent. 2009; 10(1):42-5. doi:10.1007/bf03262667
16. Krämer S, Fuentes I, Yubero MJ, Encina C, Farfán J, Araya I, *et al*. Absence of tongue papillae as a clinical criterion for the diagnosis of generalized recessive dystrophic epidermolysis bullosa types. J Am Acad Dermatol. 2020; 83(6):1815-6. doi:10.1016/j.jaad.2020.03.117
17. Cianfarani F, Zambruno G, Castiglia D, Odorisio T. Pathomechanisms of altered wound healing in recessive dystrophic epidermolysis bullosa. Am J Pathol. 2017; 187(7):1445-53. doi:10.1016/j.ajpath.2017.03.003
18. Naso G, Petrova A. Cellular therapy options for genetic skin disorders with a focus on recessive dystrophic epidermolysis bullosa. Br Med Bull. 2020; 136(1):30-45. doi:10.1093/bmb/ldaa029
19. Condorelli AG, Dellambra E, Logli E, Zambruno G, Castiglia D. Epidermolysis bullosa-associated squamous cell carcinoma: From pathogenesis to therapeutic perspectives. Int J Mol Sci. 2019; 20(22) doi:10.3390/ijms20225707
20. Martins VL, Vyas JJ, Chen M, Purdie K, Mein CA, South AP, *et al*. Increased invasive behaviour in cutaneous squamous cell carcinoma with loss of basement-membrane type vii collagen. Journal of Cell Science. 2009; 122(11):1788-99. doi:10.1242/jcs.042895
21. Marini I, Vecchiet F. Sucralfate: A help during oral management in patients with epidermolysis bullosa. J Periodontol. 2001; 72(5):691-5. doi:10.1902/jop.2001.72.5.691
22. Sindici E, Astesano S, Fazio L, Dragonetti A, Pugliese M, Scully C, *et al*. Treatment of oral lesions in dystrophic epidermolysis bullosa: A case series of cord blood platelet gel and low-level laser therapy. Acta Derm Venereol. 2017; 97(3):383-4. doi:10.2340/00015555-2512
23. Osipowicz K, Wychowanski P, Nieckula P, Shamsa S, Wertheim-Tysarowska K, Wozniak K, *et al*. Efficacy of gentamicin 0.3% solution of oral erosions healing in patients with severe generalized recessive dystrophic epidermolysis bullosa and its impact on the expression of type vii collagen. Postepy Dermatol Alergol. 2021; 38(6):979-84. doi:10.5114/ada.2020.97072
24. Vanden Oever M, Twaroski K, Osborn MJ, Wagner JE, Tolar J. Inside out: Regenerative medicine for recessive dystrophic epidermolysis bullosa. Pediatr Res. 2018; 83(1-2):318-24. doi:10.1038/pr.2017.244
25. Harris JC, Bryan RA, Lucas VS, Roberts GJ. Dental disease and caries related microflora in children with dystrophic epidermolysis bullosa. Pediatr Dent. 2001; 23(5):438-43.
26. Wright JT, Fine JD, Johnson L. Hereditary epidermolysis bullosa: Oral manifestations and dental management. Pediatr Dent. 1993; 15(4):242-8.
27. Liversidge HM, Kosmidou A, Hector MP, Roberts GJ. Epidermolysis bullosa and dental developmental age. Int J Paediatr Dent. 2005; 15(5):335-41. doi:10.1111/j.1365-263X.2005.00649.x
28. Turkyilmaz A, Bulut AC, Hancerliogullari D. Endodontic management of a patient with dystrophic epidermolysis bullosa: A case report. Aust Endod J. 2021; 47(1):97-104. doi:10.1111/aej.12480
29. Delebarre H, Chiaverini C, Vandersteen C, Savoldelli C. Orofacial management for epidermolysis bullosa during wisdom tooth removal surgery: A technical note. J Stomatol Oral Maxillofac Surg. 2019; 120(5):467-70. doi:10.1016/j.jormas.2019.03.007
30. Al-Abadi A, Al-Azri SA, Bakathir A, Al-Riyami Y. Dental and anaesthetic challenges in a patient with dystrophic epidermolysis bullosa. Sultan Qaboos Univ Med J. 2016; 16(4):e495-e9. doi:10.18295/squmj.2016.16.04.016
31. Bowen L, Burtonwood MT. Anaesthetic management of children with epidermolysis bullosa. BJA Educ. 2018; 18(2):41-5. doi:10.1016/j.bjae.2017.11.005
32. Smith GB, Shribman AJ. Anaesthesia and severe skin disease. Anaesthesia. 1984; 39(5):443-55. doi:10.1111/j.1365-2044.1984.tb07313.x
33. Holzman RS, Worthen HM, Johnson KL. Anaesthesia for children with junctional epidermolysis bullosa (letalis). Can J Anaesth. 1987; 34(4):395-9. doi:10.1007/bf03010142

Online CPD in **6 Easy Steps**

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

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.16406

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

SADJ May 2023, Vol. 78 No.4 p207-210

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

1. DO DIFFERENT ORTHODONTIC PLIERS USED IN BRACKET DEBONDING HAVE DIFFERENT EFFECTS ON PAIN AND SENSITIVITY?

Pain is an important physiological and emotional experience, whose intensity may vary with age, gender, emotional state, cultural background and previous pain experience.[1] Almost 95% of patients undergoing orthodontic treatment have reported varying degrees of pain. After an orthodontic force is applied, an immediate and a delayed painful response occurs[1]. While the cause of the immediate response was to be the compression of the periodontal ligament (PDL), the delayed response was attributed to the hyperalgesia of the PDL. This hyperalgesia is associated with prostaglandins which make the PDL sensitive to algogens released in the environment, such as histamine, bradykinin, serotonin and substance[1].

During the removal of the brackets, mechanical stresses occur in the PDL with the force applied to the tooth. Studies have reported that patients are able to withstand intrusive forces significantly more than torsional and extrusive forces. In order to reduce the pain or discomfort during removal of orthodontic brackets, different methods such as taking analgesics, using special debonding pliers, finger pressure, or biting a cotton roll, wax template or acrylic wafer are recommended.[1]

The debonding procedure includes removing the brackets and residual adhesive. Removal of the brackets can be done using tools such as bracket removing pliers, ultrasound, laser and electrothermal debonding. In addition to these, removal of residual adhesive can be done using tungsten carbide burs, fiberglass burs, adhesive removal pliers, abrasive discs, ultrasound and laser[1].

Meriç and Kılınç (2022)[1] reported on a trial that sought to evaluate the effects of two different orthodontic pliers on pain experience during debonding and to evaluate whether the air and cold stimuli applied after debonding (T1) and one week later (T2) caused an increase in sensitivity. The null hypotheses were as follows: (1) There was no difference between the pain experience scores caused by weingart and bracket remover plier during debonding; (2) There would be no difference in sensitivity scores due to air and cold stimulation applied after debonding and one week later.

Materials and methods

This was a prospective, split-mouth study comprising 35 subjects who completed orthodontic treatment. Patients were included if: (1) They were aged between 13-24 years old, (2) They provided informed consent, (3) They were bonded with 0.022" slot metal brackets and double buccal tubes (Mini Master Series), and (4) They had good general and oral health. Patients were excluded if they had a history of previous orthodontic treatment, had any history of systemic disease that could be associated with dentine hypersensitivity, and had a history of taking medicine in the previous 24 hours prior to the start of the study.

Allocation concealment was done using opaque sealed envelopes. In each patient, two diagonal quadrants (upper right and lower left or vice versa) had been randomly assigned to the Bracket remover plier "BRP" group and contralateral diagonal quadrants to the Weingart plier "WP" group. If the debonding process started with "BRP" (upper right), the other side (upper left) was debonded with "WP" pliers and vice versa.

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.16406

Blinding at the debonding appointment was not possible as the operator in that time point was performing debonding. However, thermal stimulation in the T0, T1 and T2 time points was made by an independent researcher who was unaware of the previous processes. The analyst was blinded to all stages.

In all patients the enamel surface was etched using 37% phosphoric acid gel for 20s and rinsed. Light-cured Transbond XT primer and adhesive (3M Unitek) were used to bond bracket and tubes. At the debonding appointment (T0), compressed air and freshly melted ice water was applied to each tooth before the brackets were removed. First, air was applied to all teeth, and after 1min, cold stimulus was started. Air stimulus was applied (1s) using air–water syringe under constant pressure, and cold stimulus was applied (3s) with freshly melted ice water using dental syringe. Both stimuli were applied to the buccal cervical third of each tooth.

The level of discomfort felt by the patient during the application of air and cold stimulus was asked verbally and recorded by the patient individually for each tooth. The 11-step numeric rating scale (NRS) tool between 0 and 10 was used to assess discomfort (0=no pain, 10=worst pain imaginable).

After the air and cold stimulation was completed, the brackets were removed. All brackets were debonded by the same right-handed operator. Brackets and tubes were debonded using both bracket remover plier and weingart plier in a split-mouth design. While debonding was performed using weingart plier, the brackets were debonded by squeezing them from the mesial-distal surfaces, while debonding was performed using bracket remover plier, the brackets were removed by squeezing their upper and lower wings.
During debonding, patients were asked to bite a cotton roll in order to reduce discomfort. Rectangular stainless steel archwires were left in situ during debonding procedure. The debonding was started with the upper right quadrant, then continued with the upper left, lower left and lower right quadrants, respectively. The first bracket removed in each quadrant was the buccal tube of the 1st molar tooth and the debonding process towards the anterior teeth was completed in order. The level of discomfort was asked verbally and recorded for each tooth during the bracket removal. After all brackets were removed, residual adhesive was cleaned carefully by using slow-speed tungsten carbide finishing bur. Air and cold stimulations were repeated and recorded after the debonding (T1) and one week later (T2).

Results

Of the 35 patients, 2 were excluded from the analyses. There were slightly more females (51.5%) compared to males (48.5%). Tooth extraction was performed in 57.6% of the patients. The mean age of the patients was 17.1 years, and the mean duration of treatment was 34.7 months.

According to the WP and BRP groups, there was no statistically significant difference between the median values of sensitivity scores by applying air before debonding in both upper and lower teeth (T0 time point) ($p>0.050$). According to the Weingart plier “WP” group and the Bracket remover plier “BRP” group, there was no statistically significant difference between the median values of sensitivity scores by applying cold before debonding in both upper and lower teeth (T0 time point) ($p>0.050$).

A statistically significant difference was found between the distribution of debonding pain scores in the Upper 4 teeth according to the removal pliers ($p=0.017$). The median pain score of the WP and BRP pliers was 0. This difference is due to the difference between negative and positive ranks. Positive rank was obtained as 1 while negative rank was obtained as 8. This is an indication that WP plier pain scores are higher than BRP plier pain scores. A statistically significant difference was found between the distribution of debonding pain scores in the L6 tooth according to the removal plier ($p=0.026$). Median pain score of WP and BRP plier was obtained as 0. This difference is due to the difference between negative and positive ranks. Positive rank was obtained as 3 while negative rank was obtained as 10. This is an indication that the pain scores of the WP plier are higher than the pain scores of the BRP plier. There was no statistically significant difference between the distribution of pain scores in the other teeth according to the removal plier ($p>0.050$).

There was no statistically significant difference between the distribution of debonding pain scores both in lower and upper teeth in WP and BRP pliers according to gender ($p>0.050$).

A statistically significant difference was found between the distribution of sensitivity scores measured at T1 time in the U3 tooth by applying air according to the WP and BRP groups ($p=0.024$). The median values of WP and BRP pliers were obtained as 0. This difference is due to the difference between negative and positive ranks. While the positive rank was 0, the negative rank was obtained as 6. This is an indication that WP plier sensitivity scores are higher than BRP plier sensitivity scores. There was no statistically significant difference between the distribution of sensitivity scores measured at T1 time in the other teeth by applying air according to the pliers ($p>0.050$). According to the WP and BRP groups, there was no statistically significant difference between the median values of sensitivity scores measured at T1 time both in upper and lower teeth by applying cold ($p>0.050$).

According to the WP and BRP groups, there was no statistically significant difference between the median values of sensitivity scores measured at T2 time both in upper and lower teeth by applying both air and cold ($p>0.050$).

There was no statistically significant difference between sensitivity scores of teeth in three time points by air and cold application both in WP group and in BRP group ($p>0.050$).

Conclusion

The researchers concluded that while the debonding pain and sensitivity scores were statistically significant between the teeth assessed, there was no clinical significance between the two pliers in terms of pain and sensitivity. No gender difference was found in pain perception.

Implications for practice

Both methods of debonding and bracket removal were found to have equivalent performance when measured against the pain and sensitivity outcomes.

REFERENCE

1. Meriç, P, Kılınç DD. Do different orthodontic pliers used in bracket debonding have different effects on pain and sensitivity? A prospective split-mouth study. Clin Oral Invest 2022; 26: 6551–6561

https://doi.org/10.17159/sadj.v78i04.16406

2. EFFECTS OF CONVENTIONAL COMPLETE DENTURES AND IMPLANT-SUPPORTED OVERDENTURES ON ALVEOLAR RIDGE HEIGHT AND MANDIBULAR BONE STRUCTURE: 2-YEAR AND 6-YEAR FOLLOW-UP STUDY

Tooth loss and edentulism remains a significant public health problem in many parts of the developing world. Rates of edentulism among certain communities in the Western Cape have been found to be among the highest in the world. Edentulism produces physical and psychological problems that impair the individual's oral and overall health, lowering their quality of life[1].

Edentulism rehabilitation is needed in order to restore the patient's chewing function, aesthetic appearance and social life[1]. Conventional complete denture (CCD) is a common and traditional method of treating edentulism. Nowadays, edentulous people are mostly seen in the poorest segment of the population. As a result, basic and low-cost traditional prosthesis is needed. During chewing, the conventional complete denture (CCD) causes masticatory forces to transmit over the residual ridge; this may increase bone resorption. The treatment concept of mandibular implant-supported overdentures (ISO) was designed to eliminate these disadvantages in CDD and provide better retention and stability of the lower denture.

It is accepted that alveolar bone resorption after tooth extraction is unavoidable as a result of a lack of periodontal ligament stimulation. Furthermore, after tooth extraction, a scar forms on the mucosa. With the usage of a prosthesis, the surface tension force of the mucosa increases. When the produced force exceeds the physiological limit, pathological bone resorption is induced[1]. In addition, according to Wolff's law[1], jaw bones, like all bones, have the potential to adapt to functional stimulus and changing stressors. This adaptation creates a constant process of remodelling at the bone interface with osseous implants[1]. After implant insertion, functional stimulation induces bone apposition in the edentulous mandible[1].

These changes, which occur as a result of resorption and apposition in the mandibular alveolar bone, can be evaluated by measurements of the alveolar crest height. In addition, there are indices that evaluate the mandibular bone structure in general. Some of these are the panoramic mandibular index (PMI) and mandibular cortical width (MCW), gonion index (GI) and antegonial index (AI), and they are qualitative and quantitative measurements used in panoramic radiography to evaluate mandibular bone structure[1]. The angle created by a specific horizontal plane and the posterior surface of the articular eminence is known as articular eminence inclination (AEI). The condyle movement path and the degree of rotation of the disc on the condyle surface are defined by the AEI[1].

Saribal et al (2022) reported on a study that sought to evaluate the short- and long-term changes in the mandibular bone structure of patients rehabilitated with implant supported overdentures (ISOs) and conventional complete dentures (CCDs), using alveolar bone loss (ABL), radiomorphometric indices and articular eminence inclination (AEI).

Materials and methods

This study consisted of the following groups:-
"Study group 0" was the group formed using the 126 patients' first available panoramic radiographs. These first radiographs were taken 2 or more years after the patient was edentulous.

"Study group 1" was the group formed using the 126 patients' panoramic radiographs taken 2 or 6 years after their first panoramic radiograph.

The conventional complete denture (CCD) group consisted of 63 individuals who used CCD. The Short-term subgroup consisted of 30 patients who had 2-year follow-up radiographs. The Long-term subgroup consisted of 33 patients who had 6-year follow-up radiographs.

The Implant supported overdenture (ISO) group consisted of 63 individuals who used ISO. The Short-term subgroup consisted of 30 patients who had 2-year follow-up radiographs. The Long-term subgroup consisted of 33 patients who had 6-year follow-up radiographs. All ISO patients had two implants in the region between the mandibular intercanine and the maxilla was in occlusion with CDD. All prostheses used by the patients were made with the same procedure and method within the groups. The conventional impression techniques and muffle method were used. The attachment type was the O-ring system and ball attachment, in which the holding element was a rubber ring. In addition, bilateral balanced occlusion was achieved. The implant lengths were between 10 and 11.5mm and the implant diameters were between 3.5 and 4.5mm.

A control group of 126 patients was formed, which was compatible in age and gender with the research groups. These patients had a healthy periodontal condition and no tooth loss.

For inclusion:- (1) Patients were completely edentulous for more than 2 years (except for the control group), (2) The images and anamnesis records of the patients were complete, (3) There was an absence of fractures or artefacts that may interfere with measurements in panoramic radiographs, (4) Patients did not have joint complaints and/or TMJ disorder symptoms such as crepitation, clicking, popping, snapping, pain, limited mouth opening and deflection.

Patients were excluded if there was:- (1) Presence of panoramic radiograph image with low diagnostic quality, (2) Presence of any pathological lesions and/or fractures in the maxilla and/or mandible, (3) Use of drugs and/or hormone replacement therapy that will affect bone metabolism (bisphosphonate, glucocorticoid, calcitonin, fluoride etc), (4) Presence of systemic disease that will affect bone metabolism (hyperparathyroidism, thyroid disease, chronic renal disease etc), (5) Patients were receiving head and neck radiotherapy.

The same digital panoramic X-ray system and exposure parameters were used for all panoramic radiographs. Alveolar bone loss (ABL), panoramic mandibular index (PMI), mandibular cortical width (MCW), gonion index (GI), antegonial index (AI) and articular eminence inclination (AEI) measurements were made in both groups.

ABL were measured and evaluated as anterior, right-left premolar and right-left molar. On the right and left sides, panoramic morphometric indices and AEI were measured, and the averages of these values were analysed. Cohen kappa statistic values showed a strong intraexaminer agreement (0.936–0.987) and interexaminer agreement (0.942–0.956).

Results

There were 63 patients in both the ISO and CCD groups, 45 females and 18 males. There were 126 patients in the control group, 90 females and 36 males. There was no statistically significant difference between mean ages of the three groups

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.16406

(p<0.001). The mean age of the CCD group was 62.73 (11.6) years, the mean age of the ISO group was 63.24 (10.82) years and the mean age of the control group was 62.58 (11.04) years.

The "study group 0" values are the measurement results from the first available panoramic radiographs of the patients. These first radiographs were taken 2 or more years after the patient was edentulous. The "study group 1" measurements are radiographs taken 2 or 6 years after the initial radiographs. Both study groups showed significantly lower mean alveolar bone height than the control group in all mandible regions (p<0.000). Comparison with patients without tooth loss once again showed that edentulousness causes loss of the alveolar crest.

ISO group showed significantly lower mean ABL than CCD group in anterior region (p=0.000), right premolar region (p=0.005), left premolar region (p=0.005), right molar region (p<0.000) and left premolar region (p<0.000) in short term. ISO group showed significantly lower mean ABL than CCD group in anterior region (p=0.021), right molar region (p<0.000) and left premolar region (p<0.000) in long term. There was no statistically significant difference between the CCD and ISO groups in right premolar region (p=0.200) and left premolar region (p=0.134) in long term.
Both study groups showed significantly lower mean MCW (p<0.000), PMI (p<0.000), AI (p<0.000), GI (p<0.012) and AEI (p<0.002) than the control group. There was no statistically significant difference between the CCD and ISO groups in terms of changes in the mean MCW (p=0.765), PMI (p=0.328), AI (p=0.587) and GI (p=0.665) in long term (Table 5). There is no statistically significant difference between the CCD and ISO groups in terms of changes in the mean MCW (p=0.769), PMI (p=0.374), AI (p=0.577) and GI (p=0.535) in short term. There is no statistically significant difference between the CCD and ISO groups in terms of changes in the mean AEI in short term (p=0.120) and long term (p=0.154).

CONCLUSION

In the long and short term, edentulousness reduced alveolar crest height, MCW and AEI in individuals, but had no effect on PMI, AI or GI. The use of prosthesis did not prevent the decrease of alveolar crest height, MCW or AEI (CCP or ISO). In the short and long term, however, ISO prostheses caused less ABL in the mandibular anterior and molar regions than CCD prostheses.

Implications for practice

The clinical outcomes measures support ISOs instead of CCDs over both the short term and longer terms of use.

REFERENCE

1. Sirin Sarıbal G, Ersu N, Canger EM. Effects of conventional complete dentures and implant-supported overdentures on alveolar ridge height and mandibular bone structure: 2-year and 6-year follow-up study. Clin Oral Invest 2022; 26: 5643–5652

Online CPD in 6 Easy Steps

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

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.12749

An update on the effects of radiation therapy and dental management of head and neck cancer patients

SADJ May 2023, Vol. 78 No.4 p211– 216

TI Mmutlana [1], LM Sykes [2], K Naidu [3]

ABSTRACT

Defects in the maxillofacial region may result in cosmetic, functional and psychological impairment which can have far-reaching effects on patients' quality of life. Head and neck cancer may be treated with a variety of modalities including surgical resection, chemotherapy and radiation therapy. Ionising radiation destroys tumour cells, rendering them less able to divide, and thereby halting tumour progression, but also destroys many normal cells leaving patients with a number of oral and/or facial side effects, some of which develop quickly and others only becoming evident after some time. This paper will review these complications and the effects they have on patient functionally, aesthetically and psychosocially. It will also propose ways in which dentists can be part of the multidisciplinary team who try to prevent, reduce or manage post radiation sequalae, and help restore patients' dignity, functioning and general quality of life.

*The topic of osseointegrated implants in irradiated bone is a much debated, complex and controversial issue. This will be addressed in a follow-up review.

INTRODUCTION

The face is the most prominent and visible part of the body and provides a sense of identity to a person. Functionally, it facilitates expression of emotion, communication and intellect and provides the essential access to the respiratory and gastrointestinal tracts. Cognitively, it carries the sole sensory regions of vision, hearing, taste and smell. Defects in the maxillofacial region may be due to congenital abnormalities, or can arise later from disease, trauma, pathological changes, surgical interventions or radiation therapy. Many of these result in cosmetic, functional and psychological impairment which can have far-reaching effects on patients' quality of life.[1]

Authors' information
1. Idah Mmutlana, BDS, MDS(UL) MDent (Pros) Specialist, Department of Prosthodontics, University of Pretoria
2. Leanne M Sykes BSc, BDS, MDent, IRENSA, Dip Forensic Path, Dip ESMEA , FCD (Pros),Head of Department of Prosthodontics, University of Pretoria
3. Karmisha Naidu, BChD, PGD Clinical management of HIV/AIDS, PGD in Interceptive Orthodontics, MSc Dent. (Pros),Registrar in Department of Prosthodontics, University of Pretoria

Corresponding Author:
Name: Leanne Sykes
Email: Leanne.sykes@up.ac.za
https://orcid.org/0000-0002-2002-6238

Authors' contribution:
Idah Mmutlana 30%
Leanne Sykes 30%
Karmisha Naidu 40%

Head and neck cancer may be treated with a variety of modalities including surgical resection, radiation therapy and chemotherapy. These may be implemented separately or in combination, depending on the staging and type of malignancy. Both the cancers and associated treatment regimens can have a number of adverse functional and aesthetic consequences that are difficult to manage. They can affect mastication, deglutition, verbal communication, respiration, facial expression and facial appearance. The resulting morbidity and deformity may impact on the physical, psychological and social wellbeing of affected individuals, leading many to lives of self-isolation, avoidance of social and work activities, limited personal interactions and ensuing depression. Patients with advanced malignant diseases that require multimodal treatment may experience the worst of these consequences due to the extensive surgery, large radiation doses, prolonged treatment and mental anguish relating to both survival and quality of life (QOL). Management needs to include therapy directed towards improving survival, as well as provision of rehabilitation to restore function and quality of life so that patients can resume some degree of normality and reintegrate into society.[2,3] This paper will focus on the adverse effects of radiation therapy in the orofacial region, and the impact on dental management and rehabilitation.

Overview of radiation therapy in the head and neck region

Radiotherapy (DXT) has a crucial role in the treatment of many head and neck cancers as either a first line therapy or sole treatment modality, in conjunction with surgery and/or chemotherapy, or as a palliative measure. Certain types of tumours may be controlled or reduced in volume with radiotherapy. However, advanced disease and non-responsive malignancies will show a poor response. A conventional DXT protocol involves delivery of a daily radiation fraction dose of 2 Gray (Gy) for 5 days per week, continued over 6-7 successional weeks. The cumulative dosage may reach 60 and 70 Gy for those having radical therapy.[4]

The ionising radiation destroys tumour cells, rendering them less able to divide, and thereby halting tumour progression, but it also destroys many normal cells in the process. Patients can suffer from a number of side effects, some of which develop quickly and others only becoming evident after some time. The intensity, progression, potential for repair and regeneration, or subsequent permanency of the side effects are influenced by DXT planning (such as radical therapy with or without surgery and chemotherapy, accelerated hyperfraction intensity-modulated radiation therapy (IMRT) and proton beam

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.12749

therapy), cumulative radiation dose and volume, degree of vascularity, repair potential, cellularity of the tissue being irradiated, tumour type, age of patient, concurrent use of drugs for chemotherapy and other contributing physical conditions or habits.[4,5]

Oro-facial related complications of radiation therapy

Radiation therapy has a number of unavoidable immediate and delayed complications, some of which may resolve, but many are unfortunately permanent. The early effects are visible during or immediately after DXT and include oral mucositis, pain in the soft tissues and teeth, loss of taste or altered taste sensation, burning mouth, trismus and/or reduced oral opening, odynophagia, dysphagia and oral candidiasis.[6]

The delayed side effects tend to have more adverse consequences and include loss of salivary gland function due to direct damage and fibrosis of the glands as well as obliteration of their blood supply. The salivary glands are particularly sensitive to ionising radiation. A cumulative dose above 52 Gy can cause irreversible damage and dysfunction if the glands lie within the radiation field.[7,8] A reduction in stimulated salivary flow causes changes in the protein and electrolyte composition, and will impact on the many other functions of saliva. The reduced volume means a reduction in constituent protective elements such as immunoglobulins, ions, mucins and salivary proteins, which further reduces its protective and buffering capacity. Patients become more at risk for the growth of many pathologic microorganisms leading to associated oral and dental diseases such as periodontal disease and dental caries (radiation-induced caries). Other chronic sequelae include acute and chronic pain, mucositis, mucosal sensitivity, dry mouth, altered or reduced taste, mucosal and bony necrosis, difficulty with denture retention, reduced mobility of tongue, lips and jaw, and difficulties with speech, mastication and swallowing. The advent of parotid-sparing radiotherapy techniques such as three-dimensional (3D) conformal radiation therapy and intensity-modulated radiation therapy (IMRT) have shown promise in enhancing the cytocidal efficiency while at the same time reducing damage to healthy tissues.[8,9]

Periodontal problems arise if there is damage to the small vessels supplying the dentition and the gingiva. Extractions should be avoided whenever possible due to the risks of poor bone healing and subsequent devastating osteoradionecrosis (ORN). Any minor injury or inflammatory/infective diseases in these sites increase risk for osteonecrosis and osteomyelitis.[10] ORN is clinically defined as irradiated bone that has failed to heal within 3 to 9 months. It may also be described as a slow-healing radiation-induced ischaemic necrosis of the bone with variable amounts of associated soft tissue necrosis in the absence of tumour, recurrences or metastatic disease.[11] Osteoradionecrosis can cause severe pain, pus drainage and fistulae of the mucosa or skin related to exposed bone in the previously irradiated area. Predisposing factors include tumour size and location, radiation dose, occurrence of local trauma, dental extractions, oral and dental infection, immune defects and malnutrition. While some of the side effects may resolve or improve with time, professional guidance and medication, others such as poor bone healing and the risk of ORN may remain for years after completion of therapy.[5,6] A better understanding of the underlying pathophysiology may improve the ability of the clinician to prevent the occurrence and help improve the prognosis of this complication.[12]

The morbidity associated with all of these oral complications often also impacts on the rest of the body, both physically and psychosocially. Pain, lack of taste and difficulty swallowing make eating difficult and unpleasant. Patients either avoid eating or limit their diets to soft foods that are easy to swallow. This can lead to malnourishment, debilitation and susceptibility to infections. Patients with advanced lesions may also develop facial disfigurement, swallowing and mastication difficulties, unintelligible speech, limited oral function, unpleasant odour and poorer survival outcomes. These added consequences further limit their desire for social interaction and routine work, thereby drastically diminishing their QOL. Awareness, prevention or limitation, and management of these adverse sequelae is an essential role for all professionals involved in treatment and care of head and neck cancer patients. To this end they need to be knowledgeable about these issues and help devise coping strategies for the patients and their families.[6,10]

Historical and histopathological perspectives in osteoradionecrosis (ORN)

As early as 1922, the first report about osteoradionecrosis of jaws after radiotherapy was published.[13] Since then many clinicians reported on this phenomenon, often using different names such as “radiation osteitis” and “osteomyelitis”. Its presence was always feared due to the devastating damage it caused and extreme difficulty in treatment.[14] Nearly 50 years later, Mainous (1975) advocated the use of hyperbaric oxygen therapy (HBO) to treat radiation-induced tissue injury. This led Marx to conduct extensive research into the field. In 1983 he published many position papers on therapy protocols that have been widely followed and implemented. He proposed the hypoxic, hypocellular and hypovascular theory to provide a better understanding of the pathophysiology of osteoradionecrosis. He believed that hyperbaric oxygen therapy could be used as an adjunct to surgery but not as a treatment modality on its own as it cannot resurrect dead bone or reverse radiation damage entirely.[15]

Although there is no evidence that HBO cures mild or moderate ORN, it is reported to be useful for preventing late-onset radiation-induced tissue damage by improving mucosal healing, restoring bone continuity, decreasing wound dehiscence and increasing vascular perfusion to the soft tissue and, to a lesser extent, the underlying bone. It may also help improve or stabilise other symptoms such as xerostomia, pain, erythema and oedema. Despite these advantages, HBO therapy requires a considerable amount of equipment, is time consuming, expensive and some patients reported it to be claustrophobic. Moreover, in reality HBO is not practical, as it requires at least 20-30 sessions in a compression chamber, each lasting 90 min, and often further follow-up “dives”.[16]

Over the years HBO therapy has come in and out of favour, leading others to seek more predictable and better alternatives. Delanian and Lefaix in 2004 considered the damage seen in ORN to be due to radiation-induced fibrosis of the normal tissues and bone.[17] However, this theory can be discounted if the histopathological features

https://doi.org/10.17159/sadj.v78i04.12749

of ORN are to be considered. Radiation-induced changes in the tissue result in hypocellularity and hypovascularity leading to tissue hypoxia. Initially the damage is seen in the smallest of vessels causing hyperaemia followed by endarteritis, thrombosis and, finally, total obliteration.[18] This hampers the tissue's ability to repair itself, and even routine physiological remodelling and repair decrease or cease. If this compromised tissue is then faced with increased repair requirements as a result of trauma, cellular death and collagen lysis will exceed synthesis and cellular replication, resulting in a non-healing wound in which the energy, oxygen and metabolic demands exceed the supply.[19,20] It furthermore makes the bone more susceptible to infection.

The mandible is at an increased risk of ORN compared to other bones in the craniofacial skeleton which receive their blood supply from vessels that enter the bone via direct muscular attachments, periosteal perforators and intramedullary vessels. The mandible is a denser bone that receives far less perfusion from these sources making it more susceptible to the development of osteoradionecrosis.

Prevention and management of osteoradionecrosis (ORN)

It is recommended that dental extractions and any elective oral and/or dental surgical procedures should be avoided during and immediately after radiation therapy due to the poor wound healing and risk of ORN. If extractions are unavoidable, they must be as atraumatic as possible and the clinician must ensure there is no remaining sepsis, bleeding or open sockets. Patients must be advised to report early symptoms or clinical signs of pain, swelling or non-healing lesions so they can be attended to immediately.[7, 21]

Martos-Fernández *et al* (2018) reviewed the literature on the fibro-atrophic theory of ORN along with the use of a combination drug therapy regime of pentoxifylline, tocopherol (PVe) and clodronate (PENTOCLO®) to prevent ORN. The theory is based on fibroblast activation and dysregulation. In the onset and progression of ORN, there is an early "prefibrotic phase" with an intermediate "organised phase" and a final remodelling "fibroatrophic phase". Thus drug therapies that have been proposed offer targeted approaches to different aspects of the fibroatrophic model. The free radical scavenger tocopherol protects cell membranes against peroxidation of lipids, thereby reducing ROS generation from oxidative stress. Tocopherol can also inhibit tumour necrosing factor alpha (TNF) and downregulates procollagen gene expression, which also reduces fibrosis. In combination with this, pentoxyfylline, a methylxanthine derivative with an anti- TNF α effect, has an inhibitory effect on fibroblast activation as well as increasing collagenase activity.[17,22,24] Martos-Fernández et al (2018) found limited data, and no consensus on the efficacy, optimal therapeutic doses or suggested treatment time for this proposal.[24]

More recently, investigations have been carried out with various bisphosphonate drugs. Clodronate is a first-generation, non-nitrogenous oral bisphosphonate which is not associated with drug-induced osteonecrosis and can reduce osteoclast activity, decrease fibroblast and macrophage proliferation, and promote bone formation by osteoblasts.[24] Its enhanced antifibrotic effect may make it beneficial in the treatment of ORN. As seen by the number of studies in this field, there is no consensus and much controversy about the ideal therapy for prevention and treatment of ORN. It is widely agreed that a multimodal approach is needed, with some researchers suggesting additional antibiotic and anti-inflammatory treatment prior to starting antifibrogenic drugs, to resolve osteitis and achieve a greater healing effect.[25]

The role of the dentist in treating irradiated patients

The management of patients receiving DXT to the head and neck region should be based on early intervention and preventative care, initiated prior to radiation therapy. Ideally patients should be seen by a multidisciplinary team at the initial consultation and treatment planning session. Thereafter, the general dentist should carry out a thorough examination of hard and soft tissues together with appropriate radiographs to evaluate the oral health status and, at the same time, consider future rehabilitative needs.[7] Initiation of radiation therapy should be delayed until periodontal and crucial dental procedures have been completed and there is clinical and radiographic evidence of healing. Any invasive dental procedures should ideally be completed at least 3-4 weeks prior to starting DXT. Oral hygiene instructions and tailor-made programmes are necessary to motivate patients on the importance of dental hygiene. This is especially needed as they often avoid meticulous brushing and flossing due to pain and limited mouth opening. Additionally, dietary counselling is fundamental to their wellbeing and healing post-therapy. It may also be necessary to prescribe adjunctive aids such as salivary stimulants, artificial saliva, analgesic or antibacterial mouth rinses, and dietary supplements though some sialagogues may elicit unwanted gastrointestinal side effects. Patient education with regards to the disease process, its prevention and management is vital.[7,21]

Radiation therapy complications in children

While childhood malignancies are relatively uncommon, they do occur. Treatment that involves radiation therapy to the head and neck region in children is more aggressive than in adults and carries a high risk of cranio-facial disfigurement and asymmetry of skeletal structures.[26] If given during the period of tooth formation, it may result in numerous types of tooth or root aberrations. Retinoblastoma is the most common primary malignancy in childhood. Surgical enucleation is the treatment of choice; however, in bilateral cases radiotherapy and chemotherapy may be used to try to preserve the possibility of vision in at least one eye.[21,26]

The congenital absence or acquired loss of the globe during childhood is both cosmetically and psychologically debilitating. In addition, normal socket and facial development is dependent on orbital growth. Thus loss of the eye, combined with scarring and radiation damage, will further compromise the development of the orbital region. The resulting socket becomes progressively and comparatively reduced in size as the rest of the face develops. It may also develop hypoplastic soft tissue and shortening of the eyelid rim and subsequent facial asymmetry. This makes the prosthetic rehabilitation especially challenging in young children and adolescents.[26]

Management of dentate and partially dentate patients

In dentate patients, a tooth by tooth analysis will determine which teeth are sound, which are salvageable if restored

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.12749

and which are not viable to treat. The aim should be to preserve as many healthy teeth as possible for both psychological and functional reasons. In addition to their use in maintaining nutritional requirements and social interactions, they may also be needed as abutments for future prostheses. Conservative restorations for carious teeth should be carried out wherever possible and as per necessity, along with procedures that may prevent future trauma such as smoothing sharp edges of chipped teeth or crowns, and addressing crowns with inadequate marginal seals. Periodontal therapy and endodontic treatment should only be carried out on teeth where there is a relatively good prognosis for improvement to avoid the need for later extractions. Fabrication of custom fluoride trays and prescription of a neutral fluoride gel is essential to help prevent development of post radiation caries.[7] Teeth with a poor prognosis should be extracted in a low traumatic manner to limit damage to the bone and surrounding tissues. Thereafter it is recommended to wait at least two weeks before commencing with the radiation therapy.[21] Patients with existing crown and bridge work need to have these restorations examined closely. Poorly-adapted margins and pontic sites can be a source of plaque accumulation and need to be addressed. Similarly, those with existing implants need clinical and radiographic examination to ensure there are no signs of infection or peri-implantitis. They should also be placed on an implant maintenance programme as removal of failing implants post-radiation therapy carries as much risk for ORN as extraction of teeth*.

Management of edentulous patients

Patients with existing full or partial dentures should be examined for areas of mucosal trauma. Ill-fitting and fractured dentures should be adjusted, repaired or relined wherever possible. Stability and occlusion should be assessed to prevent traumatic interferences from developing. If their condition and cleanliness is poor the patient must be advised to discontinue use, and rather have a replacement denture made. It is, however, advisable to delay new denture fabrication as the surgical resection and/or radiation changes may alter the alveolar shape. This can create defects that will affect the denture bearing tissues thus compromising the fit, retention and stability of the new dentures. This may also predispose the patient to denture-induced trauma and the development of ORN if bone is exposed.[27]

Preventative dental prostheses used during radiation therapy

The number and severity of complications associated with radiotherapy has prompted clinicians to develop various radiotherapy prostheses aimed at reducing or preventing complications, or improving the effectiveness of the radiation delivery. Early examples of these date back to the 1930s where materials like rubber, wax and modelling compounds were used to fabricate these devices. As the years progressed, these were replaced with acrylic resins and lead plates. The prostheses have varying names associated with different functions i.e. spacers, shields, tissue protectors and radiation carriers. They are custom made for each patient and may incorporate channels through which the radiation material is delivered, as well as lead plates to protect the healthy underlying or adjacent tissues. These stents and shields have contributed to better treatment results and fewer complications allowing for rehabilitation to begin earlier and more safely in the post radiotherapy phase.[28,29]

Dental management after irradiation in the head and neck region

Ideally dentists will have had an opportunity to consult with patients prior to their radiation therapy. Often their first encounter is only during or after treatment when a patient seeks help for symptoms or side effects that have developed due to their radiation. The first step is to elicit when the treatment commenced, date of completion, the type, mode and site of therapy, and the total cumulative dosage received. Any signs of bony exposure, oral/skin fistulas or swellings of the soft tissues require immediate attention, and are best referred to a maxillofacial surgeon for further management. The dentition should also be examined for the presence of tooth mobility, which could indicate underlying pathology. Pain, anaesthesia or dysesthesia must be viewed with suspicion and, if needed, investigated further and treated accordingly.[7,21]

Oral hygiene and nutritional reinforcement is often needed as the mucositis, pain, discomfort and xerostomia hamper both and can result in ulceration, caries and reduced quality of life.[30]

Wearing of dentures post radiation has not been shown to increase the risk of ORN provided that the dentures are well-fitting; however, there does appear to be an increased risk for soft tissue trauma.[31] Furthermore, the discomfort from mucositis and xerostomia can make denture wearing uncomfortable and patients being unable to use them irrespective of how well the dentures previously fitted and functioned. This is primarily due to poor retention and difficulty forming a food bolus, chewing and swallowing as a result of the xerostomia.

Sialagogues (pilocarpine 5mg t.d.s. taken half an hour before meals) can help if there is residual gland function; however, if the major salivary glands have been included in the radiation field this will be of limited value. Patients may rather experiment with artificial salivary replacements, or frequent small sips of water. Sucking on sugar-free sweets and chewing gum may help stimulate flow, but there is a risk of radiation-induced caries developing if they develop a habit of sucking on sugary or acidic sweets. The progression of caries and predisposition to bacterial and fungal infections is exacerbated by the lack of saliva and its associated cleansing, buffering and antimicrobial action. Use of a neutral topical stannous fluoride gel (0.4%) in custom made fluoride trays may help protect the teeth. Limited use of non-alcohol antiseptic mouth rinses (chlorhexidine 0.12%), antifungal topical oral gels (Miconazole 2%m/m) or lozenges (Miconazole 10mg, t.d.s for 7-10 days) and analgesic mouth gels (Xylonor 5% lidocaine) can be prescribed if indicated.[7, 21,31]

Patient maintenance

The main goals of patient maintenance are to prevent any future dental extractions to limit the chances of ORN developing, maintain a healthy oro-facial environment, and offer patients support and assistance during this time of adaptation. Mucositis, pain and discomfort slowly lessen but damage to salivary glands, bone and certain other tissues may be irreversible. A maintenance programme is important to ensure that oral hygiene remains optimal, and patients' mouths are kept plaque- and caries-free. This also allows clinicians to check the surgical sites for any evidence of

https://doi.org/10.17159/sadj.v78i04.12749

dehiscence and infection and, more importantly, to monitor for any recurrence of the cancer.

Simultaneously, a holistic approach is needed. Clinicians are at times so focused on trying to rehabilitate the patient by restoring their lost function and appearance that they forget the psychological impact that cancer has on the patients, their dignity and their families. A deeper level of understanding, empathy and support will help those affected to come to terms with their diagnosis of cancer and be more prepared for the consequences that may follow. Counselling will help prepare them for the possibility of disfiguring surgery, side effects of adjunct chemotherapy and radiation and of having to adapt to a prosthesis. It is imperative that a clinical psychologist, dietician and physiotherapist be part of the multidisciplinary treatment team.

Patients may suffer from losses in strength, vision, dexterity, muscle strength and energy which will affect their ability to look after their own oral and general hygiene. A caregiver or family member may need to be educated on helping patients clean their defects and also with attachment, removal and cleaning of their extra oral prostheses. Physical therapy can help relieve oedema, soften and stretch fibrous tissue, increase the range of joint motion, restore circulatory efficiency, increase muscular strength and retain muscular agility.[31] Custom made mouth opening devices and exercises are useful for those who have developed trismus due to damage to their temporomandibular joints or who have limited mouth opening due to muscular and soft tissue fibrosis. They also assist the patient in increasing the mouth opening for speech, mastication and oral hygiene.[28]

Maintenance and cleaning of any intra- or extraoral prosthesis is important for hygienic purposes, to prevent them from becoming contaminated with microorganisms and to prolong their longevity. As healing occurs the defects change in size and shape due to scar tissue contracture, decreased swelling, tissue remodelling or recurrent tumour growth. This affects their fit, seal, retention, stability and performance.

Extraoral prostheses may be retained mechanically, with attachments and osseointegrated implants*, or with medical adhesives. The latter are generally water soluble and relatively easy to remove from the fitting surface of the silicone and the skin. However, the daily application and removal can easily tear and distort the thin margins and lead to skin irritation. Over time, the colour also fades, along with the deteriorating fit. Frequent follow-up visits are needed to re-stain or remake appliances and also to allow the dentists to monitor the tumour site for early signs of infection, necrosis or cancer resurgence.[12]

Similarly, frequent replacement of obturators and intraoral prostheses is necessary to accommodate tissue changes, and ensure adequate retention, extension and border seal. Retentive elements such as housings, ball abutments or implants will also require technical maintenance and be periodically replaced*.

Denture wearing in the early days after surgery/radiation should be discouraged due to the friable nature of the underlying tissue as well as the frequently encountered xerostomia which compromises denture retention. The dry mucosa is also more prone to trauma if the dentures are rough, ill-fitting or move about too much. Patients who have existing dentures should limit their use during the first year while the tissues are still compromised. The general dentist can help limit mucosal damage by smoothing sharp edges, repairing fractures or placing soft reline material into the fitting surface. Note: The use of the latter carries an additional duty on the dentist to monitor their condition, and replace these frequently as the material is prone to harden and distort with time. They are also porous and easily become contaminated with bacterial and fungal organisms which is a further hazard to the already compromised oral tissues. These materials also have reduced wettability, which increases the drag on the dry mucosa during function, further increasing the risk of soft tissue trauma. They must be used with caution and care.[21, 27, 31] New dentures should only be fabricated if the tissues are healthy, free from ulceration or persistent tumour, have no irregular bony prominences that may become exposed, and the patient must have an acceptable level of oral hygiene.[21, 27] If the patient suffers from xerostomia, the clinician must ensure that oral tissues are lubricated prior to taking impressions or carrying out any of the subsequent clinical stages of denture fabrication to prevent iatrogenic trauma to the mucosa. The use of salivary substitutes may be needed clinically and recommended for home use as well.[31]

A further consideration is that patients with severely fibrosed tissues, or who have had extensive resective surgery, may not have enough sulcus depths or ridge heights left to support or retain a denture. A vestibuloplasty may be required, but must be carried out with as low trauma as possible, and sufficient healing time allowed prior to fabricating the new denture.

CONCLUSION AND RECOMMENDATIONS

Evidence-based practice and sound principles should be used when deciding on the best and most appropriate treatment for a patient with head and neck cancer. However, individual patient circumstances, needs, desires and preferences must also be considered. The treatment planning and execution should ideally be performed by a multidisciplinary team where all the oral health care providers communicate and work together to provide comprehensive care for the patient. Practitioners need to have a holistic approach, realising that the initial diagnosis of cancer is usually shocking and emotionally disturbing to the sufferer as well as their friends and family.

Their interventions should not be based solely on eradication of a disease, but must also encompass an understanding of how this will impact on the patient's quality of life and psychosocial interactions. In addition, they have a duty to try to educate patients on lifestyle habits such as smoking and alcohol cessation, good oral hygiene practices and avoidance of risk factors for oral cancers. Ideally, they should consult newly diagnosed cancer patients prior to commencement of any surgery or radiotherapy where they can carry out a pre-radiation dental assessment, provide surgical stents or radiation shields, carry out emergency dental work and institute early oral hygiene programmes. They should also prepare patients for the imminent radiation-induced side effects, and emphasise the need for regular

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.12749

recall visits to help them deal with these, and to prevent the development of more sinister complications.

It is important to take into account the mental anguish experienced by clinicians treating patients with head and neck cancers and their subsequent defects, and the psychological impact it can have on their lives. Perhaps the profession needs to consider the wellbeing of both the patients and the clinicians as equally important. To this end, as clinicians we owe it to ourselves and our colleagues to provide more information, resources and help on how to "care for the care-givers".

REFERENCES

1. Roger, S.N. (2010) Quality of life perspective in patients with oral cancer. Oral Oncology, Vol. 46, pp. 445-47
2. Moser, V.F et al (2003) Cancer Rehabilitation particularly with aspects of physical impairment J. Rehab Med. Vol. 35, pp. 153-162
3. Roger, S.N. (2010) Quality of life perspective in patients with oral cancer. Oral Oncology, Vol. 46, pp. 445-47
4. Sciubba JJ, Goldenberg D. Oral complications of radiotherapy. Lancet Oncol. 2006;7:175-183
5. Hancock PJ, Epstein JB, Sadler GR. Oral and dental management related to radiation therapy for head and neck cancer. J Can Dent Assoc. 2003;69:585-590
6. Kim JK, Leeman JE, Riaz N, McBride S, Tsai CJ, Lee NY. Proton therapy for head and neck cancer. Curr Treat Options Oncol. 2018;19:28
7. Bhandari et al. Radiotherapy-induced oral morbidities in head and neck cancer patients, Spec Care Dentist. 2020;40:238–250
8. Porter SR, Scully C, Hegarty AM. An update of the aetiology and management of xerostomia. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2004: 97: 28–46
9. Balzan AP *et al*. Oral rehabilitation following treatment for oral cancer, Periodontology 2000, Vol. 57, 2011, 102–117
10. Costantino PD, Friedman CD, Steinberg MJ. Irradiated bone and its management. Otolaryngol Clin North Am 1995; 28(5): 1021–1038
11. Wong JK, Wood RE, McClean M. Conservative management of osteoradionecrosis. Oral Surg Oral Med Oral Pathol 1997; 84: 16–21
12. Suryawanshi AT et al (2014). Maxillofacial Osteoradionecrosis. J Dent Res Rev; 1: 42-49
13. Murray CG, Herson J, Daly TE, Zimmerman S. Radiation necrosis of the mandible: A 10-year study. Part II. Dental factors; onset, duration and management of necrosis. Int J Radiat Oncol Biol Phys 1980b;6:549-53
14. Kluth EV, Jain PR, Stuchell RN, Frich JC Jr. A study of factors contributing to the development of osteoradionecrosis of the jaws. J Prosthet Dent 1988;59:194-201
15. Marx RE. A new concept in the treatment of osteoradionecrosis. J Oral Maxillofac Surg 1983;41:351
16. Bennett MH, Feldmeier J, Hampson NB, Smee R, Milross C. Hyperbaric oxygen therapy for late radiation tissue injury. Cochrane Database Syst Rev. 2012;(16)
17. Delanian S, Lefaix JL. The radiation-induced fibroatrophic process: Therapeutic perspective via thantioxidant pathway. Radiother Oncol 2004;73:119-31
18. Chaux-Bodard AG, Gourmet R, Montbarbon X, Bodard S, Breton P. Postradiation dental extractions. Rev Stomatol Chir Maxillofac. 2004;105:269–73
19. Ruggiero S, Gralow J, Marx RE. Practical guidelines for the prevention, diagnosis and treatment of osteonecrosis of the jaws in patients with cancer. J Oncol 2006; 2: 7–14
20. S. Saldanha et al. Dental implications of bisphophonate-related osteonecrosis, Gerodontology 2012; 29: 177–187
21. Beumer J 3rd, Curtis T, Harrison RE. Radiation therapy of the oral cavity: sequelae and management, Part 1. Head Neck Surg 1979a;1:301-12
22. Aggarwal K et. Prophylactic Use of Pentoxifylline and Tocopherol in Patients Undergoing Dental Extractions Following Radiotherapy for Head and Neck Cancer, Niger J Surg 2017 Dec 23(2);130-137
23. Benjamin D et al Pentoxifylline and Tocopherol in the Management of Temporal Bone Osteoradionecrosis: A Case Series, Otology & Neurotology: December 2020 - Volume 41 - Issue 10 - p 1438-1446
24. Martos-Fernández et al. Pentoxifylline, tocopherol and clodronate for the treatment of mandibular osteoradionecrosis: a systematic review Oral Surg Oral Med Oral Pathol Oral Radiol 2018;125:431–439
25. Robard L, Louis MY, Blanchard D, Babin E, Delanian S. Medical treatment of osteoradionecrosis of the mandible by PENTOCLO: preliminary results. Eur Ann Otorhinolaryngol Head Neck Dis. 2014;131:333-338
26. Goel G K. Rehabilitation after Surgical Treatment for Retinoblastoma: Ocular Prosthesis for a 6-Month-Old Child, Journal of Prosthodontics 21 (2012) 408–412
27. Abed H, Burke M, Scambler S,Scott SE. Denture use and osteoradionecrosis following radiotherapy for head and neck cancer: A systematic review. Gerodontology. 2020;37:102–109
28. Mantri S et al. Scope of prosthodontics services for patients with head and neck cancer, Indian J Cancer 2012;49: 39-45
29. Taniguchi H. Radiotherapy prostheses. J Med Dent Sci 2000;47:12-26
30. Elting LS, Cooksley CD, Chambers MS, Garden AS. Risk, outcomes, and costs of radiation-induced oral mucositis among patients with head-and-neck malignancies. Int J Radiat Oncol BiolPhys. 2007;68:1110-1120
31. White JM, Panchal NH, Wehler CJ, et al. Department of Veterans Affairs Consensus: Preradiation dental treatment guidelines for patients with head and neck cancer. Head & Neck. 2019; 41:1153–1160

CPD questionnaire on page 222

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

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.16410

Refusing to treat – is it legal? Is it justifiable? Is it ethical?

SADJ May 2023, Vol. 78 No.4 p217– 219

LM Sykes[1], AM Van Zyl[2], AMP Harris[3]

INTRODUCTION

Historically, when clinicians wanted to know if certain conduct was ethical, they would consult the guidelines set out in the Hippocratic oath. While adherence to the oath may "represent an expression of the professions' ethical obligations", and be useful in promoting their commitment to "abide by these norms", this assumption is open to question.[1] Different practitioners may see and interpret the codes in different ways, depending on their personal ethos as well as the specific time and situation under consideration. At the same time, ethical material can and should reform, and when needed, be re written under optimal cool, calm conditions. Changes should be based on "contributions from those with a variety of perspectives who have access to as much available knowledge as possible" and not implemented as a result of immediate pressures where there may be distorting circumstances.[1] Perhaps the best way to judge their value is to debate how well the code addresses the issue at hand in terms of its "comprehensiveness, clarity and consistency".[1] This paper uses an actual patient scenario as a basis on which to pose some clinically and ethically related queries and postulate possible solutions.

CASE SCENARIO

A 20-year-old student had just returned after a 2 year study scholarship in Cuba. During this time she had commenced with specialised orthodontics to correct her bite and improve her aesthetics. Treatment included tooth extraction and full arch banding in both the maxilla and the mandible. However, her study time had ended before her therapy had been completed. Upon her return she began to experience problems with some of the fixed appliances debonding and wanted to have all of the bonded brackets removed as she felt that they were no longer making any difference to her tooth position, and she was satisfied that her teeth had been moved sufficiently. They were also becoming uncomfortable, affecting her speech and an aesthetic concern. She sought help from local orthodontists, who all insisted that she must first get them copies of her dental, and specifically orthodontic history from the treating clinicians in Cuba before they would commit to taking her on as their patient. She had tried for weeks to track down her previous dentists or her record files, but had no success with either. In the interim more of her brackets were starting to become loose and yet no orthodontists would see or treat her. In desperation she turned to the HPCSA for help and guidance.

Authors' information
1. Leanne M Sykes *BSc*, *BDS*, *MDent*, IRENSA, Dip Forensic Path, Dip ESMEA, *FCD* (Pros) Head of Department of Prosthodontics, University of Pretoria
2. Albert M van Zyl, BDS (UWC), PDD (Interceptive Orthodontics) https://orcid.org/0009-0003-3411-7979
3 Angela M Harris, *BChD* (Stell), Hons *BSc*(Med Sci)(Stell), Dipl Ter Educ (Unisa), MChD Orthodontics (Stell), FFD(SA)Ortho, PhD(UWC) https://orcid.org/0000-0001-6237-1200

Corresponding Author
Name: Leanne Sykes
Email: Leanne.sykes@up.ac.za
https://orcid.org/0000-0002-2002-6238

Authors' contribution:

Leanne M Sykes: Primary author	50%
Albert van Zyl	25%
Angela Harris	25%

LEGAL GUIDELINES REGARDING TERMINATION AND REFUSAL TO TREAT

There is a clear distinction between the situation where a clinician feels it necessary to terminate a doctor-patient relationship and where they refuse to accept a new patient up front. This paper will focus on the latter. However a brief mention of factors that may justify termination will be given initially.

1. Reasons for treatment termination

There are many and various clinical, personal or professional situations that may lead to a breakdown in the doctor-patient relationship and lead a clinician to terminate treatment. For example:

a) Patient non-compliance / adherence. This includes patients who fail to keep scheduled appointments, who do not follow the doctor's advice or instructions, or persist with destructive habits. These patients may also have an increased risk of disease, have poorer treatment outcomes, place a heavier financial, time or psychological burden on themselves and their treating clinicians, and deprive others of much needed care.[2]
b) Patients who don't complete their full treatment, and then frequently re-appear as emergencies and demand to be fitted in. Doctors may also fear that these patients could damage their reputation if seen by other colleagues at a later stage, where their previous history is not known.[2]
c) Patients who are unwilling to accept a proposed treatment, who insist on treatment that goes against the clinical judgement and / or ethics of the doctor, or demand interventions that may be harmful to themselves.
d) Where the doctor-patient relationship has broken down to such an extent that it is better to refer the patient elsewhere.[3,4]
e) Violent or threatening patients.[3]
f) Patients with chronic drug seeking behaviour.[5]

If a clinician does wish to withdraw their services they should first establish the reasons behind the relationship breakdown[4], as well as the level of persistence and extremity of the difficulty.[5] They may initially explore possibilities of reconciliation, such as setting new boundaries, and only withdrawing if the patient does not adhere to these.[4] However if all reasonable attempts fail, they should be aware that "struggling to maintain a chronically stressed doctor-patient relationship may be riskier than a well-timed termination".[5] They should then explain to their patients why they have decided to withdraw from treating them, and

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.16410

try arrange for a suitable referral. They should also transfer copies of all the patient's records to the new practitioner as soon as possible.[4] Patients should also be made aware that there are different systems in place for this, and that the transfer of records may require additional fees.[1] In the interim, they have an ethical duty to continue providing basic care, or treat emergencies.[3]

2. Situations that may prompt clinicians to refuse to treat

Most doctors enter the profession in order care for and treat patients in need. This "duty of care" is based on the ethical principle of beneficence, and acting in the best interest of others.[6] They are also obliged to treat any patient who presents with an emergency that needs immediate attention.[5] However, no clinician is legally bound to care for all patients needing their services, or to carry out treatment that makes them uncomfortable. They are free to decide who to accept as a new patients[6], even if no other clinician is available.[1] They may also refuse to commence with more treatment in existing patients. However, legally in the latter case, it is advisable for them to notify the patient "sufficiently long in advance of withdrawal to allow time for another practitioner to be found".[1] Their decision is often based on a personal judgement call, and as such needs to be defensible, legal and ethical.

Reasons for refusing treatment are vast and varied, and may include:

a) Conscious objection where the treatment requested goes against their own professional judgement, beliefs or philosophies. The literature is replete with debates that either support or admonish this stance. Some authors question whether a doctor should be allowed to refuse to treat a patient based on personal values, unless such treatment would cause more harm than good;[7]
b) They feel the work needed is beyond their capabilities or skills, or outside their scope of practice;
c) They wish to avoid inflicting pain on patients due to treatment that they feel has limited benefits;
d) Where they feel there will be a poor outcome[7], or that the patient may end up in a worse state than if no treatment had been done;
e) They calculate that the administration time and effort needed prior to commencing the clinical work (if any) will not justify the amount they can charge for their services. For example, in cases where patients have medico-legal disputes and they need a second opinion or a clinical report. The dentist will have to open a file, examine the patient, try contact previous practitioners to source old records, write medico legal reports, offer an expert opinion, and then may never be the one to carry out further treatment. They may also feel obliged to render emergency care for problems they did not create;[2]
f) They may be reluctant to take over a patient where work was started by a colleague as they could then become accountable for the outcomes, and have to manage any adverse consequences;
g) It is not financially viable for them to complete work that a colleague started, and where the patient has used up all of their funds on the initial stages;
h) They may elicit from the patient's records that other dentists or specialists have refused further treatment and be cautious about becoming involved. This is especially so where patients have moved between many clinicians and bad mouth their previous dentists;
i) When they suspect (or know) that the patient has outstanding debts with colleagues;
j) Where there is an ongoing dispute, grievance or legal case between the patient and another practitioner;
k) They don't trust the information given to them by the patient;
l) The patient is mentally unstable or not able to give true informed consent;
m) Their practice is not equipped with the necessary materials or equipment needed to carry out the work correctly.

Note that the above examples all differ from paternalism. In the latter the clinician agrees to treat the patient, but decides on what work is done based on what they think is in the patient's best interest.[8]

No doctor is forced to take on any new patients against their will. However, refusal to treat must never be a response to a personal bias, or discriminatory opinion.[3,4,7] At the same time, if a clinician decides not to treat, they should consider whether their refusal to act is in the patient's best interest.[4] How they handle the situation thereafter is often more important than the decision itself. They could offer to transfer the patient to someone else. This may be a colleague who is more skilled, has better facilities or has had training in a particular field; to a specialist; to a medical practitioner; or any other person they deem appropriate to manage the patient.[4] Before arranging the referral they should inform the patient clearly and calmly and give the reasons for their decision, so that the "refusal cannot be seen as an act of unlawful discrimination or unprofessional conduct".[3,4,7] Of course the situation becomes more complex if the dentist is unable to find a suitable person who is willing to take on a new patient. Can they ethically "abandon the patient after a reasonable, good-faith effort to find an alternative pracitioner" has failed?[1]

From a legal perspective, section 27 of the constitution of the Republic of South Africa 1996 affords "every patient the right to health care services and guarantees that no one may be refused emergency health care", so they are not only ethically but also legally obliged to deliver this if the patient has a genuine emergency. However, what constitutes an emergency or the need for immediate care varies widely in both medicine and dentistry, and between different organisations, countries, and people. It often relies on the clinician's opinion, based on their training and experience. For example, Canadian legislature defines an emergency as "a medical condition manifesting itself by acute symptoms of sufficient severity (including severe pain) such that the absence of immediate medical attention could reasonably be expected to result in any of the following: placing the patient's health in serious jeopardy; serious impairment of bodily function; or serious dysfunction of any bodily organ or part".[9] The decision may be judged against the "reasonable man" rule of how other practitioners would view the situation.[10] In most instances a basic screening examination should be done on any person who presents as an emergency. This will both safeguard the practitioner and show beneficence towards the patient.

3. Ethical concerns and Patient-related considerations with regards to withholding treatment

A patient who seeks dental treatment does so with a desire and / or need for physical, psychosocial, emotional, comfort,

https://doi.org/10.17159/sadj.v78i04.16410

functional or aesthetic reasons. Refusing to treat will thus negatively affect them in any number of these domains. In this particular case scenario, the lack of treatment was already causing emotional distress to the young lady, as well as physical discomfort, and psychosocial embarrassment due to the effect the braces had on her speech and aesthetics. From a dental perspective, there was the risk of her oral and dentition condition deteriorating. The occlusion could be affected by non-functional orthodontic appliances if more active movement and /or orthodontic retention treatment was needed. She was also at increased risk of developing tooth demineralisation or caries under the bands or periodontal disease due to her compromised ability to clean. The loose bands had already begun to cause mucosal damage and posed a choking hazard. She suffered further harm in the form of wasted time, frustration, mental anguish, depression and a feeling of complete helplessness.

4. Possible solutions

In this situation if the new dentist / orthodontist agreed to treat, they would still need to see previous records to evaluate her initial condition and compare it with her current situation. This in itself may be problematic. Her previous dentist may be reluctant to release copies of the records if they have not kept adequate documentation, or if there is an outstanding debt. This then deprives the new practitioner of valuable information that could impact on their further management. In any event, the new clinician would still require a new, complete set of records, including radiographs (panoramic and cephalometric), clinical photographs and scans or study models for diagnostic and treatment planning purposes, and to keep in their own files.[10] These documents would allow them to determine if the dental alignment and occlusion had improved and to draw up a new treatment plan if they identified the need for further orthodontic treatment, restorative work, tooth splinting, periodontal therapy or aesthetic procedures such as bleaching and veneers. Comprehensive pre-and post treatment records are crucial in all of dentistry, but even more so if there is a risk that the treatment outcomes may not be ideal or in accordance with the patient's desires or expectations.

Prior to commencing with any clinical procedures, they would have to spend time discussing the situation with the patient to make sure she was aware of why all of the above was necessary, that she may need more treatment for which she would have to pay, and to ensure she provided autonomous, informed consent.[11] They would be justified to bill for their initial consultation, as well as for the extra time spent trying to access old records, and for all subsequent clinical diagnostic aids needed. Should the patient be unable to afford this, they could arrange a referral to a state dental clinic. Considering the ordeal that this lady had already suffered, it would be gratifying if they communicated directly with a practitioners at the referral centre to see if she could be given priority over a less urgent case. However, enabling a patient to "jump a waiting list" is unfair towards those who may have been waiting some time for treatment. Liang has questioned the ethics of weighing up patients and then prioritising treatment for those considered to be the most deserving. He considers this to be tantamount to a clinician becoming the judge over who has the greatest needs, and acting in a manner that is not necessarily in the best interest or fair to all patients. They also run the risk of making decisions that are based on personal opinions and could be subject to bias. For example, a dentist may favour certain types of patient such as those with the best / worst dentitions, or needing the least/ most complex work, depending on how each one suits their practice profile and treatment preferences.[7]

CONCLUSION

This paper highlights the importance of a strong doctor-patient relationship. This is even more crucial in cases where the patient has long-term treatment needs such as fixed orthodontics, or complex restorative or periodontal therapy which can span over months or years. It also cautions practitioners to be aware that their rights to refuse a patient for no reason does not imply a right to refuse them for any reason. That is to say that their arbitrary decision cannot be based on any form of underlying discrimination.[1] Perhaps the final question that must be posed is whether refusal to treat is acting in the patient's best interest, is ethically justifiable and legally defensible? Many times it is "How the refusal to treat is managed, rather than the decision itself that makes the difference" between ethical patient management and unprofessional conduct.[4]

REFERENCES

1. Freedman B. Health professions, codes, and the right to refuse to treat HIV-infectious patients. Hastings Centre Report. 1988.18(2):suppl 20-25.
2. Mantel J. Refusing to treat noncompliant patients is bad medicine. Cardoza Law Review. 2017. Vol 39: 126-133.
3. Medical Protection Society. Removing patients from the practice list. Accessed at:https://www.medicalprotection.org/ireland/practice-matters/issue-2---september-2013/removing-patients-from-the-practice-list. Accessed on: 24-04-2023
4. Browne P. Refusal to treat: When is it ok to say "no"? Avant- Refusal to treat. 2015. Accessed at : https://www.avant.org.au/news/20150503-refusal-to-treat-when-is-it-ok-to-say-no/. Accessed on: 24-04-2023
5. Lippman H, Davenport J. Patient dismissal: The right way to do it: Under what circumstances is it permissible for a physician to "fire" a patient? J Family Prac; 2011;60(3)135-136
6. Brijnath B, Mazza D, Kosny A et al. Is clinician refusal to treat an emerging problem in injury compensation systems? BMJ Open 2016;6:e009423. Doi10.1136/bmjopen-2015-009423. Accessed on: 26-04-2023
7. Liang S. Should doctors be allowed to refuse to treat their patients? Accessed at:https://journals.mcmaster.ca/meducator/article/view/701/668; Accessed on 01-05-2023.
8. Sandman L, Munthe C. Shared decision making, paternalism and patient choice. Health Care Anal. 2010;18(1):60–84. doi: 10.1007/s10728-008-0108-6
9. Derlet RW, Nishio DA. Refusing care to patients who present to an emergency department. Ann Emerg Med; 1990;19:262-267
10. Rischen RJ, Breuning KH, Bronkhurst EM, Kuijpers-Jagtman AM. Records needed for orthodontic diagnosis and treatment planning: A systematic review. 2013. Accessed at: https://doi.org/10.1371/journal.pone.0074186. Accessed on: 04-05-2023
11. Mizrahi E. Risk management in clinical practice. 2010. Part 7. Dento-legal aspects of orthodontic practice. British Dental Journal 209(8):381-390

www.sada.co.za / SADJ Vol. 78 No.4
https://doi.org/10.17159/sadj.v78i04.16411

Cone beam computed tomography use in sialolithiasis of the submandibular salivary gland

SADJ May 2023, Vol. 78 No.4 p218

S Rajbaran Singh[1], NJ Mashigo[2]

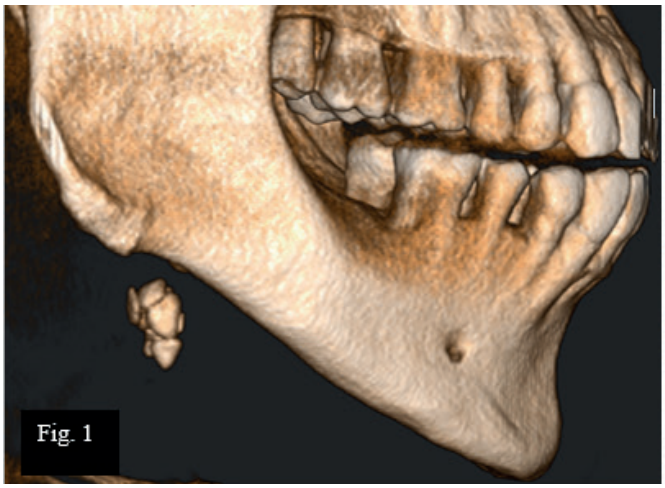


Fig. 1


Fig. 2

KEYWORDS
Sialolith, submandibular gland, soft tissue calcification, cone beam computed tomography

A 62-year-old diabetic male patient presented with right-sided facial pain associated with a firm palpable mobile mass in the right submandibular area.

Following initial examination, cone beam computed tomography (CBCT) investigation demonstrated multiple smooth homogenous calcifications (Figure 1) collectively measuring 12mm x 9mm x 8mm within the region of the right submandibular gland (Figure 2). On resection of the submandibular gland, the histological features of the lesion were confirmed to be those of chronic sclerosing sialadenitis supporting the clinical impression of a sialolith.

Sialolithiasis, one of the mo st common disorders of the major salivary glands, is characterised by calcifications within the ducts or parenchyma of the affected glands. Plain radiography is of limited value in the evaluation of sialoliths due to inadequate localisation and superimposition over bony structures.

Authors' information:
1. Sandeepa Rajbaran Singh, *MSc.Odont, Dip* Odont, *BChD, Dip HRM,* School of Oral Health Sciences, Sefako Makgatho Health Sciences University (SMU), Ga-Rankuwa, South Africa. ORCID: 0000-0003-0658-2542
2. Naome Joyce Mashigo, *BDS*, School of Oral Health Sciences, Sefako Makgatho Health Sciences University, (SMU), Ga-Rankuwa, South Africa.

Corresponding Author:
Name: Dr S Rajbaran Singh
Tel: +27 12 5214902
Email: Sandeepa.singh@smu.ac.za

Sialography, a widely used imaging technique, entails injecting a contrast medium into the Stensen's or Wharton's duct to identify the outline of the ductal anatomy and any presence of sialoliths.[1] This imaging technique provides excellent contrast resolution and provides for the detection of early and small calcification.[2]

Submandibular sialography bears disadvantages of the invasiveness of the procedure, cannulation complications and operator skill. Conventional sialography uses panoramic, occlusal and postro-anterior radiographs which provide appropriate views (with cumulative radiation exposure) for examining the major salivary glands.

CBCT is increasingly used in maxillofacial and oral imaging owing to the advantageously high isotropic spatial resolution of osseous structures. CBCT does not demonstrate ductal anatomy or the relationship of calculi to surrounding tissue as medical computed tomography (CT) does.[3] CBCT, however, allows for localisation, dimensions of calculi and facilitates differentiation from other pathology when superimposed over the mandible. Based on the diagnostic information relative to the radiation dose CBCT offers value to the dental practitioner in the diagnosis and management of sialoliths.

REFERENCES
1. Tassoker M, Ozcan S. Two cases of Submandibular Sialolithiasis detected by Cone Beam Computed Tomography. IOSR Journal of Dental and Medical Science.2016;(15):124-129
2. Burke CJ, Thomas RH, Howlett D. Imaging the major salivary glands. Br J Oral Maxillofac 2. Surg 2011; 49(4):261-9
3. Miloglu Ö, Çaglayan F, Ezmeci T, Dagistan S, Demirtag Ö. Multiple cases of submandibular sialolithiasis detected by cone beam computed tomography. J Dent Fac Atatürk Uni 2010; 3 (20):189-193

SADA
THE SOUTH AFRICAN DENTAL ASSOCIATION

YOUNGDENTISTS COUNCIL SADA

YOUNG PUBLISHER COMPETITION GUIDELINES 2023

The Young Dentists Council (YDC) of the South African Dental Association (SADA) hereby extends an invitation to all South African Academic Institutions and Public as well as Private Health Facilities to participate in their 4th annual SADA YDC 2023 Young Publisher Competition. The competition will be hosted at the SADA Dental & Oral Health Congress & Exhibition 2023, which will be held from the 25th - the 27th of August 2023 at CTICC2, Cape Town.

We, therefore, request Deans and their relevant Heads of Department to pre-select candidates to participate in the poster competition. Eligible principal candidates must be postgraduate students. Eligible independent dental researchers are also encouraged to submit their abstracts.

Posters can be submitted in the following four categories of research:
- Undergraduate clinical research
- Undergraduate non-clinical research
- Postgraduate clinical research
- Postgraduate non-clinical research

The research project must be presented in the form of a poster and the 3 finalists will be invited to a 10-minute (maximum) interview session with the judges. The slot will comprise a 10-minute presentation by the participant and a 10-minute discussion/questions opportunity for the judges. English will be the language of the competition.

Eligible researchers
The principal candidate must be:
· 35 years of age or younger at the time of the Young Publisher Competition.
Co-researchers should also be members of SADA but may be older. There should be a maximum of three co-authors.

DUE DATES FOR ABSTRACT SUBMISSION AND PROGRAMME
- Abstract Submission opens 1 March 2023
- Abs•tract Submission closes 17 July 2023
- Judging 24 Aug 2023
- Presentation on Main Podium 25 August 2023
- Award Ceremony 26 August 2023

Oral Presentations of the poster will be restricted to 20-minute slots per finalist which includes questions posed by the judges. Answers given should be clear and concise reflecting an understanding of the subject matter.

Guidelines for the Young Poster/Publisher competition
1. Manuscript (maximum 10 pages) and abstract to be
2. Hereunder the abstract guidelines
   - Word count limit - maximum 500 words
   - Title
   - Background/Significance
   - Aims and objectives
   - Methods
   - Results
   - Conclusions

3. Judging of the final 3 posters will take place on the 24th of August 2023. Time and specific venue for presentations will be communicated to the finalists once all abstracts have been accepted and the final participants' numbers are confirmed.
4. Authors should report to the judging venue at least 30 minutes before the Judging Session.
5. All Posters will be in digital format

JUDGING OF POSTERS
Judges will follow the preselected criteria for the judging of the posters and the winner will be announced at the Gala dinner on 26 August 2023 at the CTICC2.

There will be one overall winner.

The Young Researcher award judging criteria is as follows:
CRITERIA
Appearance
- Does the poster make an impression on the viewer?
- Professional appearance; the good flow of information; logical layout; easy to read; neatness. How much text does the poster contain?
- Is there any grammar or spelling mistake?

Title
- Clear and concise; specific; adequate.

Background
- Provides sufficient rationale for pursuing the study.
- Aims and Objectives
- Clearly stated and relevant.

Methods
- Strong and appropriate for testing this hypothesis or fulfilling the study objective.

Results
- Quality of the graphs, tables, and figures; the complexity of the results; validity of these statistical methods.

Discussion
- Shows a rational understanding of the results and literature.

Conclusions
- Reflective of the Aims and Objectives; supported by data; consistent with the hypothesis being tested.
- Are the limitations of the study/suggestions for future research identified?

Scientific content
- Relevant; contributing to the advancement of Dentistry.

*****The final score will be derived from the manuscript and the poster.

AWARD CEREMONY
Finalists will be invited with their partners to attend the Gala Awards Function on 26 August 2023 when the winner will be announced.

AWARDS
- SADA Young Publisher Award
- Award winner/s shall be announced in the SADJ
- Free SADA membership for 2024
- Cash Prize of R3000
- Fully sponsored local Congress.

CONTACT PERSON PROF DIRK SMIT (DSMIT@UWC.AC.ZA) AND
PROF RIAAN MULDER (RMULDER@UWC.AC.ZA)
(PLEASE SEND ABSTRACTS VIA EMAIL TO THESE E-MAIL ADDRESSES)

www.sada.co.za / SADJ Vol. 78 No.4

CPD questionnaire

The effect of COVID-19 lockdown on the epidemiology of maxillofacial trauma at tertiary health facilities in Pretoria

1. Select the CORRECT answer. What was the common site of injury in this study?

A. Mandible
B. Orbital bone
C. Midface
D. Upper face.

2. Which of the following is CORRECT. COVID-19 started in the following city

A. Wuhan City
B. New york
C. Manchester
D. Johannesburg.

3. Select the CORRECT answer. What is the median age of the patients in the study

A. 70
B. 50
C. 34
D. 81

4. Which of the following is CORRECT. Studies on paediatric maxillofacial injuries (MFIs) show which of the following to be the most common cause of MFIs in South Africa:

A. Domestic violence
B. Road traffic accidents (RTA)
C. Falls
D. School violence

5. Select the CORRECT answer. It has also been reported in the literature that Maxillofacial trauma tends to occur during

A. Mornings
B. Afternoons
C. Evenings
D. a and b

The dental management of patients with recessive dystrophic epidermolysis bullosa: a case report of two siblings

6. Which of the following options is CORRECT. Dystrophic epidermolysis bullosa is characterized by blisters that form due to a split which occurs at the level of the:

A. Epidermis
B. Lamina lucida
C. Lamina densa
D. Below the lamina densa

7. Choose the CORRECT option. Recessive dystrophic epidermolysis bullosa (DEB) is:

A. Is more common than dominant DEB
B. Is more severe than dominant DEB
C. Can be diagnosed through a biopsy and histopathological assessment
D. Not present at birth

8. Select the CORRECT statement. Skin cancer in recessive dystrophic epidermolysis bullosa (RDEB),

A. Is the most common cause of death among patients with RDEB
B. Commonly occurs on sun-exposed skin
C. Can successfully be treated by conservative surgical excision
D. Can readily be identified due to its characteristic appearance

A 30-year Review of Ameloblastoma: A tertiary hospital-based study

9. Select the CORRECT answer, In the study one of the following is not a histological subtype that was found

A. Granular cell
B. Plexiform
C. Acanthomatous
D. Carcinoma

10. Choose the CORRECT option. With regards to Worth's description of Ameloblastic lesions, which was the most common?

A. Soap bubble
B. Honey Comb
C. Spider web
D. Other

11. Which option is CORRECT. Ameloblastomas are most likely to occur in which part of the maxillofacial region

A. Body of the mandible
B. The ramus of the mandible
C. The condylar neck and head
D. The Maxilla

12. Which answer is CORRECT. What is the overall ratio between females and males?

A. 2.3: 5
B. 3: 7
C. 1.18:1
D. 4.1: 6

13. Select the CORRECT option. Which age group is predominantly affected by Ameloblastomas

A. 43 years and older
B. The elderly 72 years and older
C. The teenagers 12 to 15 years old children
D. 40 years and younger

\

An update on the effects of radiation therapy and dental management of head and neck cancer patients

14. Select the CORRECT statement. Radiotherapy (DXT):

A. Is seldom used in the treatment of head and neck cancers
B. Is seldom used as a first line of treatment for head and neck cancers
C. May be used as a sole treatment modality for head and neck cancers
D. Is most suitable for advanced tumours of the head and neck region
E. May be given as a single dose or over a series of weeks depending on time available

15. Which of the following is CORRECT. The ionizing radiation:

A. Specifically damages only tumour cells
B. Specifically targets the blood vessels supplying the tumour cells
C. Seldom targets nerves or blood vessels
D. Seldom causes permanent side effects
E. Seldom damages only tumour cells

16. Select the CORRECT answer. Radiation induced xerostomia:

A. Is due to direct damage to salivary glands
B. Is due to damage to blood vessels supplying the glands
C. Is seldom permanent
D. Both a) and b) above are correct
E. Both a) and c) above are correct

17. Choose the CORRECT option. Osteoradionecrosis:

A. Is irradiated bone that has failed to heal within 3 to 9 weeks
B. Is a type of radiation-induced ischaemic necrosis
C. Does not affect soft tissues
D. Does not occur if the tumour has been controlled
E. Is generally asymptomatic and thus progresses quickly

18. Which statement is CORRECT. It is best to:

A. Treat retinoblastoma with radiation therapy
B. Prevent xerostomia by prescribing sialogogues prior to radiation therapy
C. Prevent post radiation caries by doing full mouth extractions prior to radiation therapy
D. Prevent osteoradionecrosis by doing full mouth extractions prior to radiation therapy
E. Limit denture wearing for at least a year after radiation therapy

Evidence Based Dentistry

19. Choos the CORRECT answer. What type of measure can pain and sensitivity be classified as?

A. Objective measure
B. Subjective measure
C. Linear measure
D. Insignificant measure

20. Select the CORRECT answer. In the Saribal et al trial, which statement is correct in terms of the findings:-

A. ISO group showed significantly great mean ABL than CCD group in anterior region
B. ISO group showed significantly great mean ABL than CCD group in right premolar region ($p=0.005$) and left premolar region
C. ISO group showed significantly great mean ABL than CCD group in left molar region
D. There was no statistically significant difference between the CCD and ISO groups in right premolar region ($p=0.200$) and left premolar region ($p=0.134$) in long term.

Ethics: Refusing to treat – is it legal? Is it justifiable? Is it ethical?

21. Select the CORRECT answer. A clinician may be justified to terminate treatment if:

A. the patient has a destructive habit and does not try control this
B. the patient habitually fails to keep scheduled appointments
C. the patient does not compete their treatment plan and returns much later
D. both a) and b) above
E. all of the above

22. Which statement is CORRECT. A dentist may refuse emergency care if:

A. the patient has outstanding debts
B. the patient has missed previous scheduled appointments
C. they suspect the patient has a drug seeking behaviour
D. all of the above
E. none of the above

23. Select the CORRECT answer. Paternalism refers to:

A. the practitioner signing parental consent forms on behalf of the parent
B. the practitioner providing treatment they feel to be in the patient's best interest
C. the practitioner gaining parental consent prior to treating minors
D. both b) and c) are correct
E. None of the above

24. Which of the following is CORRECT. A clinician cannot:

A. refuse further treatment in existing patients
B. refuse treatment in patients who are inebriated or violent
C. refuse treatment in patients who present with emergencies after hours
D. refuse treatment if they think it may have a poor outcome
E. refuse treatment if they have a conscious objection to the procedure

25. Choose the CORRECT answer. With regards to transfer of patient records: A clinician:

A. may withhold copies of records in cases of unpaid accounts
B. may charge a fee to make copies of records
C. may withhold records if they are incomplete
D. may withhold records if the patient's treatment is incomplete

www.sada.co.za / SADJ Vol. 78 No.4

Instructions to authors

THE SOUTH AFRICAN DENTAL JOURNAL
SADJ
SADA THE SOUTH AFRICAN DENTAL ASSOCIATION

Thank you for considering the submission of your work to the Journal for possible publication. We welcome papers which may be Original Research, Clinical Review, Case Reports, Clinical Communications, Letters or Notes.

The South African Dental Journal (SADJ) is a peer reviewed, Open Access Journal, published by the South African Dental Association (SADA). The Journal primarily carries research articles which reflect oral and general health issues in Africa but also publishes papers covering the widest consideration of all health sciences. In addition, items of specific relevance to members of the Association find dissemination through the Journal. The Journal is published ten times each year in electronic format. Hard copy is available by arrangement.

We shall be obliged if your submission is prepared respecting all the details listed in these Instructions. This facilitates our process and ensures more rapid responses to you. Please use and submit the Checklist for Authors suplied on page 645 for confirmation. Thank you.

Submission Enquiries

The Editorial Assistant Mr Dumi Ngoepe
Email addresses: sadj@sada.co.za/editor@sada.co.za
For submission instructions kindly refer to the "Submission instructions" page.

Language

All articles must be submitted in English. Spelling should be in accord with the Shorter Oxford English Dictionary.
All articles must be submitted in English. Spelling should be in accord with the Shorter Oxford English Dictionary.

Clinical Research

Articles should adhere to the protocols of the Helsinki Declaration: (https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical research-involving-hu-man-subjects/.

Clinical Trials

Clinical trials should conform to the Consort Statement (Consolidated Statements of Reporting Trials) and Reviews to the PRISMA checklist (Preferred Reporting Items for Systematic Reviews and Meta Analyses) (http://www.equator-network.org).

Authors

Authors should meet the criteria for authorship as in the documents of the International Committee of Medical Journal Editors (ICMJE):

1. Substantial contributions to the conception or design of the work or the acquisition, analysis or interpretation of data for the work, AND
2. Drafting the work or revising it critically for important intellec-tual content, AND
3. Final approval of the version to be published, AND
4. Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved (www.icmje.org).
5. The front page of the manuscript should list the title of the article, the author's(s') name(s), and their qualification(s), affiliations and positions held, telephone and fax numbers and address(es), including Email address(es), if available. It is especially important that details of the Corresponding Author should be clearly stated.
6. Please submit on the front page a list of up to eight Keywords.
7. In the case of multiple authors, the role played and the respective contribution made by each should be recorded. For example: "Principal Researcher- 40%, Writing Article- 30%, Tissue Analysis- 20%, Microscopic Examination- 10%", etc.
8. A recent requirement is that authors should be registered with ORCID. This is a number registering you as an Open Researcher and Contributor. Go to the ORCID website home page at https://orcid.org/ and follow the Three Easy Steps indicated in green. Please submit the ORCID number with your author details.

Title

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

Abstract

The abstract shall consist of not more than 200 words.
For research articles, the summary should be structured under the following headings: Introduction, Aims and Objectives, Design, Methods, Results and Conclusions. Do not include references in the Abstract.

Text

- Articles should be clear and concise.
- Text should be typed in Times New Roman font, size 11; double-spaced with a 3 cm. margin on the sides, top and bottom. Each page must be clearly numbered.
- Please include electronic numbering of lines throughout the document.
- Tables should be clearly identified, using Roman numerals ie. Table I, Table II etc.
- Authors are requested to note and adhere to the current style of the Journal particularly with respect to paragraph settings and headings.

Length of the article

In general, papers should be between 4000 and 5000 words, although this is flexible. The Editor reserves the right to edit the length of an article in conjunction with the author(s) and SADJ reserves the right to charge for excess/additional pages. The first four pages of original research papers published in the SADJ will be free of charge after which a charge of R500 per page or part thereof wil l be levied.

Illustrations/graphics/photographs

- Illustrations/graphics/photographs must be appropriate to the content of the manuscript.
- Digital images with a DPI of at least 300 should be supplied. Photocopies and pdf. files of photographs are not acceptable.
- **Please note:** Figures should be included in the text and sent separately in jpg. format.
- The Figure numbers must be in Arabic numerals and clearly identified for each illustration, graphic or photograph. Please remember to record Figure numbers in the text.
- **Permission:** Where any text, tables or illustrations are used

from previously published work, permission must first be obtained from the holder of copyright and a copy of the agreement must be submitted with the article. Suitable acknowledgement must be recorded in the article.

Continuing Professional Development
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.

References

- References should be set out in the Vancouver style and only approved abbreviations of journal titles should be used (consult the List of Journals Indexed in Index Medicus for these details at: http://www.nlm.nih.gov/tsd/serials/lji.html).
- References should be inserted seriatim in the text using superscript numbers and should be listed at the end of the article in numerical order.
- A reference in the text should appear as indicated: "...as the results of a previous study showed.23"
- Where there are several papers referenced, the superscript numbers would appear as: "...previous studies have shown. [3,5,7,9-12,14]"
- Do not list the references alphabetically.
- It is the author's responsibility to verify each reference from its original source. Please note that an article may be rejected if the referencing is inaccurate.
- Names and initials of all authors should be given unless there are more than six, in which case the first three names should be given, followed by *et al.,*. First and last page numbers should be given. Where it is applicable the page numbers should be abbreviated by omitting redundant numbers eg. pages 456 to 478 is recorded as 456-78, and 456 to 459 as 456-9, but 398 to 401 is recorded as 398-401.
- Notice that volume numbers are not given in bold, authors are not linked by 'and' or '&', and the year of publication appears after the name of the journal. No item should appear in italics except for foreign terms, eg *in vivo.*

Journal references should appear thus:

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

Book references should be set out as follows:

Terblanche N. Principles of Periodontology, 4th ed. London: Butterworth, 1985: 96-101.

Weinstein L, Swartz MN. Pathogenic properties of invading microorganisms. In: Sodeman WA, Smith RT, eds. Pathologic Physiology: Mechanisms of Disease. Philadelphia: WB Saunders, 1974: 457-72.

Manuscripts accepted but not yet published may be included as references followed by the words 'in press'.

'Unpublished observations' and 'personal communications' may be cited in the text but not in the reference list.

Declaration

All sources of funding, possible financial interest/s or incentives in products or services mentioned in the article must be disclosed. Authors are kindly requested to read and sign the attached declaration on page 450.

No articles that have been published previously, or that are currently being considered for publication elsewhere, will be accepted. Authors are kindly requested to verify that their article complies with this condition.

Ethics

Where relevant, authors should indicate whether their research has been approved by the Ethics Committee of their Institution or by other research ethics committees.

Conflict of interest

Authors must disclose their involvement with any company either owned by them or from which they have received a grant or remuneration or with which they have an association, and must declare any other personal interest they may have which would constitute a Conflict of Interest. These may include per- sonal relationships, academic competition, or intellectual beliefs. Should there be no applicable Conflicts of Interest this should also be so stated. The statement will be included at the end of the text.

Copyright
The South African Dental Journal is a peer reviewed, Open Access Journal, adhering to the Budapest Open Access Initiative: "By 'open access' to this literature, we mean its free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. The only constraint on reproduction and distribution, and the only role for copyright in this domain, should be to give authors control over the integrity of their work and the right to be properly acknowledged and cited."
https://access.okfn.org/definition/index.html

The Managing Editor reserves the right to decline articles, photographs or illustrations where products or services are mentioned that are not appropriate.

Submission

The paper should be submitted in one file including all Tables and Figures and their accompanying Legends Figures should also be submitted separately file in JPEG. format.

Please submit the paper in electronic format in Word along with separate Figures in JPEG. format to: sadj@sada.co.za and to neil.wood@smu.co.za, accompanied by a covering letter and the Declaration on page 450 signed by the author(s).

Galley proofs

Changes/corrections to the proofs supplied to authors must be returned to the publishers by email or by fax and not over the telephone. Galley proofs must please be returned to the publishers within four days after receipt thereof.

Editorial Policy

Authors may also wish to refer to the Editorial Policy of the SADJ available on the SADA website.

Enquiries
Enquiries regarding Journal matters can be directed to Mr Dumi Ngoepe, Editorial Assistant, at SADA headquarters on: Tel: +27 (0)11 484 5288
Email: sadj@sada.co.za

www.sada.co.za / SADJ Vol. 78 No.4

Submission Instructions

THE SOUTH AFRICAN DENTAL JOURNAL
SADJ
SADA
THE SOUTH AFRICAN DENTAL ASSOCIATION

To submit a new paper to SADJ, do as follows:

1 If this is your first time using this platform, please Register by completing the online form (once off):

Link:
https://journals.assaf.org.za/index.php/sadj/user/register

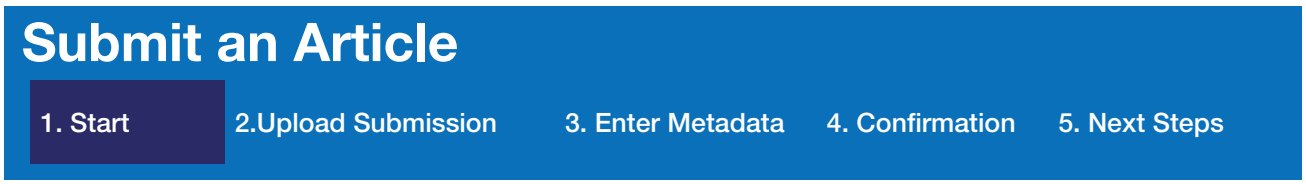
2 Once registered, make sure you are still logged in (Login every time you want to submit a new paper):

Link:
https://journals.assaf.org.za/index.php/sadj/login

3 Click on Make a new submission. on the righthand side of the page. Please ensure that the article is anonymized/No names on the submitted article

4 Familiarize yourself with the Author Guidelines. Then click on Make a new submission.

5 Follow the 5 steps as part of the wizard, until the last screen. You will receive a confirmation email once successfully submitted, and the Journal Manager/Editor will be notified.



If you are struggling on how to load/submit kindly email Dumi Ngoepe at SADA on sadj@sada.co.za for assistance.

NOTE: Incomplete submissions will be returned to the authors and will not be considered for peer-review until complete

Declaration by Author/s

THE SOUTH AFRICAN DENTAL JOURNAL
SADJ
SADA
THE SOUTH AFRICAN DENTAL ASSOCIATION

TITLE

.....

.....

.....

AUTHOR/S

.....

.....

.....

I/We, the undersigned confirm and declare that:

1. This manuscript is my/our original work and I am/we are the owner/s of this manuscript and possess rights of copyright.
2. I/we confirm that this manuscript has not been published previously and it is not currently considered for publication elsewhere. Has this article been submitted to any other journal and if so, has it been rejected?

   YES ☐ NO ☐
3. For no consideration or royalty, I/we hereby assign, transfer and make over to SADA all the rights of copyright, which have or will come into existence in relation to this manuscript.
4. I/we waive in favour of SADA or any successors in title any moral rights which may be vested in me/us.
5. The manuscript does not constitute an infringement of any copyright and I/we indemnify SADA against all loss or damage, from any cause arising which SADA may sustain as a result of having been granted copyrights to the manuscript.
6. The research has been approved by the Ethics Committee of my/our institution/s or the Ethics Commit-tee/s of other accredited research facilities.
7. I/we have disclosed in my/our Acknowledgments all sources of funding, possible financial interest/s or incentives in products or services mentioned in the paper.

..... Initial(s) and Surname	..... Signature	..... Date
..... Initial(s) and Surname	..... Signature	..... Date
..... Initial(s) and Surname	..... Signature	..... Date
..... Initial(s) and Surname	..... Signature	..... Date
..... Initial(s) and Surname	..... Signature	..... Date
..... Initial(s) and Surname	..... Signature	..... Date
..... Initial(s) and Surname	..... Signature	..... Date

www.sada.co.za / SADJ Vol. 78 No.4

Author's Checklist

1. Have you read the Instructions to Authors?
2. Are you submitting electronically?
3. Have you provided all author information including first names, affiliations, qualifications, positions held, Department and Institution, ORCID number, contact details?
4. Is the first author under the age of 35 on submission of the article?
5. Have you provided all details of the Communicating Author?
6. Have you submitted questions for the CPD section? (four or five multiple choice, one correct answer)?
7. Have you submitted details of the contribution of each author... can be percentage or descriptive... or both?
8. Is the first author under the age of 35 on submission of the article?
9. Have you provided all details of the Communicating Author?
10. Have you submitted questions for the CPD section? (four or five multiple choice, one correct answer)?
11. Are the references quoted according to Journal policy, both in the text and in the list of references?
12. Have all authors signed the Letter of Submission?

NOTES

NOTES

BENEFITS OF JOINING SADA

SADA supports its members throughout their time in the profession - from their time as students in the field, straight through their professional careers, and into retirement.

Our members benefit from the below advantages, amongst others.

Access to local and international networking opportunities, mentoring circles and study groups.

Achieve full CPD requirement through SADA's learning circles.

Full access to SADA online dental resources.

Generate your CPD Report for the HPCSA audit at the click of a button.

Personalised advice on clinical, legal and practice management as well as telephone and email support.

Get preferential rates on Dental Protection (DP) Indemnity Membership.

Access to the only fully accredited scientific dental journal in South Africa, The South African Dental Journal (SADJ), online and in hard copy.

Advertise your employment vacancies and other practice requirements for free on the SADA classifieds.

Receive discounts on SADA branch events and congresses.

Advice on South African health and safety compliance.

Access exclusive online practice related templates and contract examples.

Access independent, unbiased and superior dental mediation services.

Access to the only dental coding book in South Africa.

Eligibility for research grants from the Dental Development Foundation Trust (DDFT).

Full-time academic practitioners are eligible for an IADR membership rebate.

Members in full-time academic employment eligible to publish in the SADJ.

Assistance on medical aid authorisation parameters and risk management.

Access to relevant denta Legal, Clinical and Professional Development bulletins.

Assistance with unresolved medical schemes matters.

Purchase Profitability Assessment tool, D-Calc™ at more than 50% discount as a SADA member.

Benefit from SADA's advocacy in respect of regulatory environment as well as regulatory bodies such as the HPCSA.

Receive regular up-to-date dentistry information and news.

Contribute to and enjoy professional submission in respect to dental policies and funding.

Be part of monitoring and influencing the practice scope of various oral health care practitioners.

SADA
The South African Dental Association **(SADA)** NPC

visit our website at www.sada.co.za for more information.