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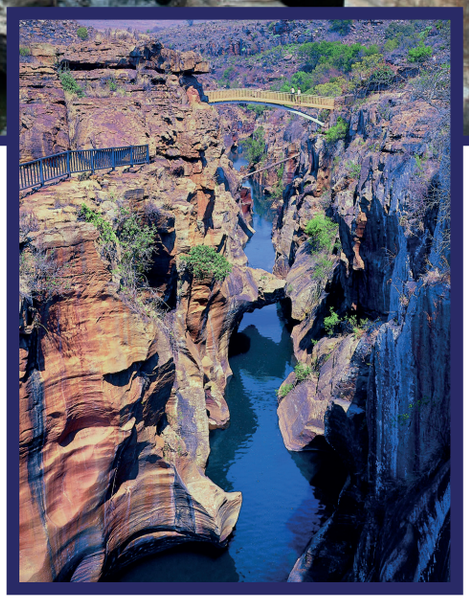

Bourke's Luck potholes of the Blyde River Canyon

These bizarre natural water features, hewn by centuries of water, mark the start of the Blyde River Canyon. Take the 700 metre walk to view these unusual water features.

SADA
THE SOUTH AFRICAN DENTAL ASSOCIATION

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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

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Our Front Cover for this Issue...

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Should dentistry play a larger role in general medicine

SADJ April 2023, Vol. 79 No.3 p1

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

Dentistry has been traditionally seen as an entirely separate field from general medicine, with a divide between the two professions. However, the current medical-dental divide is becoming increasingly problematic as oral health is closely linked to overall health. Some examples include patients who have uncontrolled diabetes mellitus, rheumatoid arthritis, patients who are transplant recipients, and elderly patients, who are adversely affected by poor oral health, and vice versa. Compounding this problem in South Africa is a large number of rural and outlying regions that need medical and dental care and intervention. At times these communities only receive periodical contact with a doctor or dentist who may be on rotation, or patients must travel large distances to community health clinics. It is conceivable that by empowering these professionals, these communities and patients will benefit greatly.

It is imperative to bridge the gap between dentistry and general medicine for better patient outcomes and reduced healthcare costs. After all we do not only fill and extract teeth, which empirically, is a narrative held by many professional colleagues. The current state of dental and medical education is one of separation, with little integration between the two professions in the senior years of training. This division between dentistry and medicine can have significant consequences for patients, as dentists may fail to recognize conditions that affect the body beyond the mouth, while medical practitioners may overlook oral health issues that can have wider implications. This lack of coordination between the two professions not only impedes the delivery of comprehensive healthcare but can also lead to missed opportunities for disease prevention and early intervention and associated economic benefits overall.

Fortunately, there is growing recognition of the need for closer collaboration between dentistry and medicine. A recent article published in the prestigious journal Nature1, states that "…the current wall between doctors and dentists must come down. By blending the two disciplines, we can harness the potential to identify and treat diseases and conditions earlier, resulting in improved patient outcomes, better management of chronic diseases, and reduced healthcare costs".

As such, there is a need to develop programs that bridge the gap between dental and medical education in the senior years of undergraduate training. By incorporating components of medical and dental curricula, students would gain a deeper understanding of the interrelationships between oral health and general health, allowing them to identify and manage conditions that affect both. Such programs would not only benefit students but would also lead to better patient care, as future practitioners would be better equipped to provide comprehensive healthcare competently. To achieve this goal, dental schools can modify their curricula collaboratively with medical counterparts to include more emphasis on medical topics. Dental students should receive more training on medical issues such as pharmacology, systemic disease management, and basic medical diagnostics. Conversely, medical students should also receive more training on oral health and its relationship to systemic diseases. This integration will allow future dentists and physicians to work together in a more collaborative manner, leading to improved patient outcomes.

The connection between general and oral health is clear. Closer collaboration between the two professions can benefit the patient, decreasing morbidity and mortality, and reducing institutional as well as individual health costs. However, this collaboration requires the training and education of future dentists to be more integrated with that of general medicine. Expanding the role of dentists in general medicine would have significant benefits for public health. Oral health is intimately linked with a range of chronic diseases, including diabetes, cardiovascular disease, and respiratory disease. As such, promoting good oral health can help to prevent and manage these conditions. By integrating dentistry and medicine, we can better address the underlying causes of chronic disease, reducing the burden of illness and improving population health.

Another important aspect of improving the training of dentists is to provide more opportunities for them to conduct research. Research plays a crucial role in advancing the field of dentistry and expanding our understanding of the connection between oral health and general health. Therefore, dental schools should incorporate more research opportunities into their curricula, allowing students to gain experience in conducting and publishing research. This will also help to increase the number of dentist-scientists, who can contribute to the advancement of the field of dentistry.

In conclusion, the separation between dentistry and medicine is detrimental to overall health, and there is a pressing need to integrate dental and medical curricula. As dental practitioners, we have a crucial role to play in general medicine, and we must embrace this role to provide the best possible care for our patients. By working together, we can promote disease prevention, better patient outcomes, more effective management of chronic diseases, and reduced costs for health-care systems. The training of future dentists should be modified to include more emphasis on medical topics, and medical students should also receive more training on oral health. Additionally, providing more research opportunities for dental students will help to increase the number of dentist-scientists and advance the field of dentistry. It is time to break down the wall between dentistry and general medicine and work together to improve overall health.

REFERENCE:

1. Molayem S. Dentists and doctors need to play on the same team. Nature Outlook 2021; https://doi.org/10.1038/d41586-021-02919-3

The South African Dental Association (SADA) Celebrates World Oral Health Day 2023 by promoting Health Education and Awareness

SADJ April 2023, Vol. 79 No.3 p2118-119

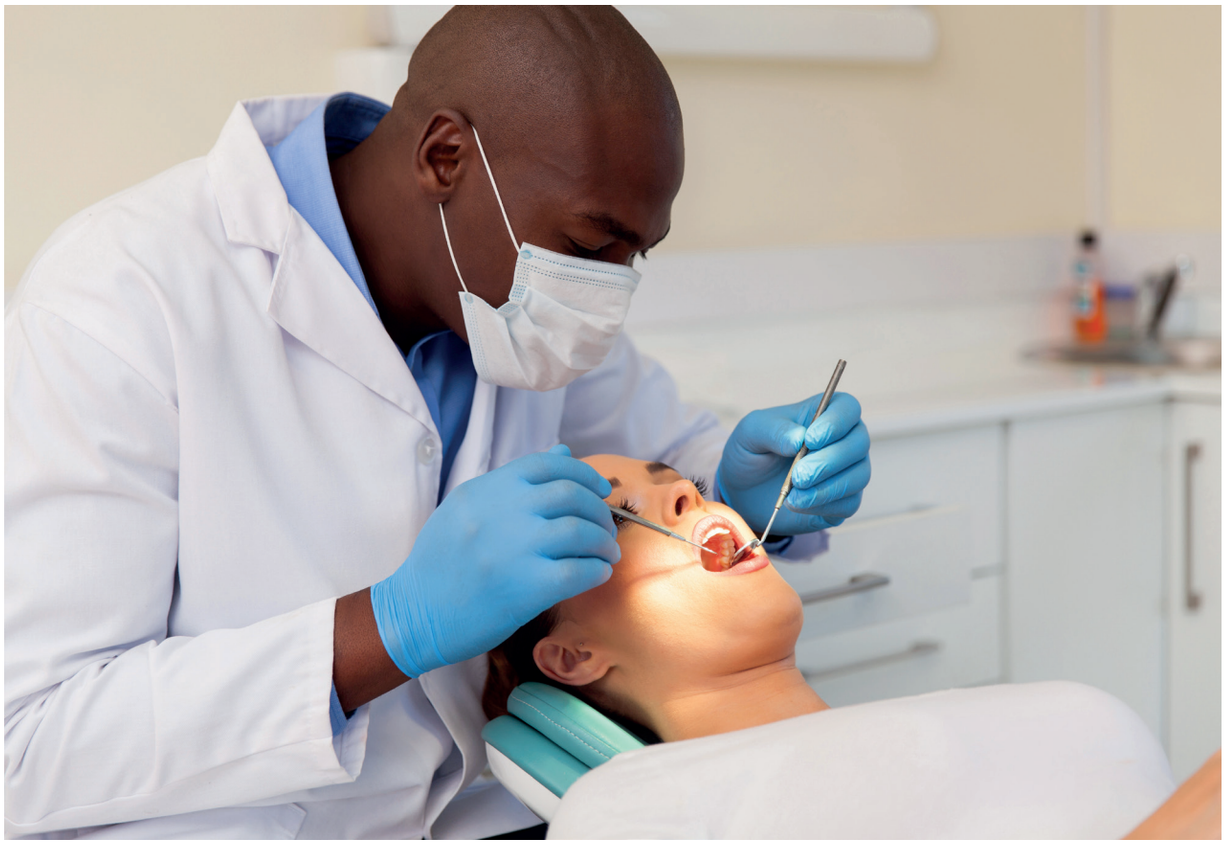
Mr KC Makhubele – CEO, South African Dental Association

World Oral Health Day (WOHD) is a global initiative that takes place annually on 20th March to raise awareness about the significance of oral health and promote good oral hygiene practices. In South Africa, WOHD was celebrated with various activities and events organized and or coordinated by the South African Dental Association (SADA), aimed at promoting oral health education and awareness among the public.

One of the key supporters of WOHD in South Africa was GSK Consumer Healthcare South Africa (Pty) Ltd, a Member of the Haleon Group, which partnered with SADA to conduct several oral health activities. One such activity involved handing out toothbrushes to young adults at children's homes, including the Abraham Kriel and Durbanville Children's Homes, emphasizing the importance of brushing teeth regularly from a young age. These initiatives aimed to instil good oral hygiene practices in young adults and promote healthy oral habits from an early age.

Another notable event was the collaboration between SADA, the YDC & SAAPD, and Colgate to distribute 20,000 oral health kits to children between the ages of 4 and 8 years all over South Africa. These kits included toothbrushes, toothpaste, and educational materials, providing children with the necessary tools and information to maintain good oral health. This initiative aimed to reach out to a large number of children and promote oral health awareness among them, creating a positive impact on their oral hygiene practices.

Furthermore, SADA, in collaboration with the University of Pretoria, organized a health day for the Down Syndrome Association on 21st March. The event aimed to provide oral health care education and support to individuals with Down syndrome, who may have specific oral health needs.



This initiative highlighted the importance of catering to the unique oral health requirements of different communities and promoting inclusive oral health care practices.

In addition to these activities, the GSK Consumer Healthcare South Africa (Pty) Ltd, a Member of the Haleon Group conducted a webinar on 23rd March, which featured Dr Rohini Bisaal, Oral Hygienist Elna van der Ham, and Dr Khanyi Makwakwa as the host. The webinar focused on various aspects of oral health education, including the importance of oral hygiene practices, the role of nutrition in oral health, and common oral health issues. With 306 viewers in attendance, the webinar aimed to raise awareness about oral health and educate the public about maintaining optimal oral hygiene.

SADA also organized a public webinar, which was available on YouTube, with Dr Khanyi Makwakwa, SADA National Liaison Officer for the World Dental Federation (FDI). The webinar addressed several topics related to oral health, including the connection between oral health and overall health, the importance of preventive oral care, and the role of oral health care professionals in promoting good oral hygiene practices. This initiative aimed to reach a wider audience and educate them about the significance of oral health in maintaining overall well-being.

The media also played a significant role in promoting WOHD in South Africa. Dr Jean van Lierop and Dr Corne Smith appeared on Expresso on SABC 3, discussing the importance of oral health and creating awareness among the viewers. Dr Paul Mathai participated in an interview on Metro FM, discussing various aspects of oral health and promoting good oral hygiene practices among the listeners. The YDC also conducted five radio interviews during the week of WOHD on the Clicks Radio Station, reaching approximately 1.2 million people in stores countrywide. All of these interviews were loaded onto the YDC Facebook page and made available on YouTube, reaching a wider audience and spreading the message of oral health awareness.

In addition to media coverage, SADA's social media outlets played a key role in promoting World Oral Health Day by reaching a bigger audience and raising oral health awareness. The impressive data on the reach and engagement of these social media campaigns demonstrate the efficacy of SADA's online presence in promoting oral health awareness. SADA's social media efforts were successful in engaging the public and raising interest in oral health, garnering over 71,000 impressions, 2,230 engagements, and 330 post link clicks across various platforms such as Facebook, Instagram, and Twitter.

In addition, SADA's Dentist Webinar, which had 306 Zoom viewers and an additional 27 YouTube viewers, offered oral health care professionals vital instruction, boosting their knowledge and expertise in promoting oral health. The radio interviews on Clicks Radio Station, which reached an estimated 1,2 million listeners each week, widened the audience for the oral health awareness message. The daily breakdown of listeners can provide additional insight into the reach and impact of these interviews.

In addition, the SAAPD contributed to social responsibility and public relations activities by delivering 170 oral health kits to cancer patients in South African wards. The collaboration between SADA and SMU was so successful that people were already asking for the event to be repeated next year – we delivered 500 oral health kits to dialysis patients. In addition to providing practical resources for oral health care, these initiatives raised awareness of the significance of oral hygiene in vulnerable groups.

In addition to social media and public events, SADA utilised email marketing to reach its wide network of connections; 9,624 people received World Oral Health Day material. This email marketing functioned as an additional successful method of disseminating the oral health awareness message and urging individuals to prioritise their oral health.

The amazing reach and impact of other events such as webinars, radio interviews, and the distribution of oral health kits reflect the success of SADA's efforts to promote World Oral Health Day in South Africa. SADA was able to promote awareness about oral health, educate the public and oral health care providers, and encourage individuals to prioritise their oral health and well-being by leveraging numerous channels and engaging multiple stakeholders.

Furthermore, SADA and other organizations utilized their websites and newsletters to share informative articles, infographics, and videos related to oral health. These resources provided valuable information on oral hygiene practices, common oral health issues, and preventive measures, further reinforcing the importance of maintaining good oral health.

Apart from public events and online efforts, SADA also engaged with oral health care professionals through continuing professional development (CPD) programs. These programs aimed to update oral health care professionals with the latest research, techniques, and best practices in oral health care. By empowering oral healthcare professionals with up-to-date knowledge, SADA aimed to enhance their ability to educate and guide patients in maintaining optimal oral health.

In conclusion, the celebration of World Oral Health Day in South Africa was a comprehensive and multi-faceted effort that involved various organizations, including SADA, GSK, Colgate, and the Young Dentists Council, among others. The activities ranged from community events, webinars, media engagements, social media campaigns, and CPD programs, all aimed at raising awareness about oral health, promoting good oral hygiene practices, and educating the public about the significance of maintaining optimal oral health. Through these combined efforts, World Oral Health Day in South Africa was successful in spreading the message of oral health awareness and empowering individuals to take charge of their oral health and well-being.

The marginal gap and internal fit of monolithic crowns milled with different luting spaces

SADJ April 2023, Vol. 79 No.3 p120-125

Al Swaid[1]

ABSTRACT

Introduction

Three of the more promising materials for CAD/CAM restorations are Zirconia (VITA Zahnfabrik, Germany), Enamic (VITA Zahnfabrik, Germany), and the composite material Brilliant Crios (Coltene, Switzerland). Zirconia has been tested for the marginal gap and internal fit; Enamic and Crios have not been tested for marginal gap and internal fit and no studies have tested the effect of different luting spaces.

Method

A standardised crown preparation on a typodont mandibular first molar tooth was scanned and imaged (CEREC CAD/CAM, Germany). The marginal gap was measured using a Reflex microscope in both two- and three-dimensions. The internal fit was calculated using the properties of the luting agent and the surface area of the preparation.

Results

The 3D measurements were significantly higher, but only on average 10µm higher. The marginal gaps of the crowns milled with a 200µm luting space were significantly smaller than for those milled with a 100µm luting space. The smallest mean gap was recorded by Enamic at 31.7µm followed by Crios at 32.5µm, and Zirconia at 33.1µm. All of these measurements are well within acceptable clinical limits.

Conclusions

All crowns milled, regardless of the luting space used, provided excellent marginal and internal fit, well within clinically acceptable parameters. The 3D measurements are more clinically relevant than 2D measurements. The smallest marginal gaps were found in the crowns milled with a 200µm luting space. However, this can present problems with non-axial seating and so it may be advisable to use the 100µm luting space parameter.

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Keywords

Marginal gap; Internal fit; CAD/CAM full coverage crowns;

INTRODUCTION

If the fit of a full crown is not accurate, there will be a marginal discrepancy which can lead to cement dissolution and microleakage,[1] pulpal involvement,[2] retention of plaque,[3] changes in the composition of the subgingival microflora[4] promoting the onset of periodontal disease.[5]

A marginal gap has been defined as "the vertical dimension from the finish line of the preparation to the cervical margin of the restoration".[6] The internal fit is the internal gap that is the misfit of the crown at the occlusal / incisal and axial surfaces.[6] The luting space which represent the internal fit should be uniform in thickness to facilitate cementation without defects in retention and resistance.[7,8]

Acceptable marginal gaps have been reported as between 7 to 65µm[9] and between 50µm and 180µm.[10,11] Most researchers agree that marginal gaps below 120µm are clinically acceptable.[12-16] The creation of a space between the dental crown and the abutment which represent the internal fit, is clinically important to ensure the proper cementation of crowns and to permit the interposition of an equal thickness layer of dental cement.

Many studies have been measured the marginal gap and internal fit of all ceramic restorations. The mean marginal gap of Nobel Procera zirconia crowns was reported to be between 52µm and 74µm,[17] and of those from a commercial laboratory, 44.2µm.[18] In a study of lithium disilicate based glass ceramic material using both CAD/CAM and heat pressed methods, the mean marginal gap was 132.2µm for CAD/CAM and 130.2µm for the heat-pressed group.[19] Anadioti (2014) reported that the marginal gap of lithium disilicate crowns was below 90µm.[20] In a study in which crowns were fabricated using Cerec3 CAD/CAM, the marginal gap ranged from 53 to 67µm and the internal fit was within a range of 116 to 162µm.[21]

The following techniques for the measurement of the marginal gap of either copings or crowns have been reported in the literature:

- Use of an optical microscope with image processing software at magnification of 240 times and measurements selected randomly at a varying number of points.[22-27]
- Measured at four points (buccocentral, linguocentral, mesiocentral, and distocentral) using a profile projector and the distance between the two points measured by the computer[21] or non-destructively using profilometry.[28]
- Use of a microscope at varying magnifications and usually

Figure 1. Tooth preparation.

four landmarks mesial, distal, buccal, and palatal.[19,29,30]

- Use of a silicone replica technique by luting the crown with a low-viscosity impression material which is subsequently stabilised with a high viscosity material in order to make sections (this method is also used to measure internal fit).[18,21,31,32-37]
- By luting the crown with dental cement such as zinc phosphate cement[38] or chemically cured composite[39] or glass-ionomer.[29] The crown and die are embedded in epoxy resin and sectioned and the cement layer thickness measured with a three-dimensional microscope.[29,32,38,40,41] and image analysis[42] and/or scanning electron microscopy.[29,39,43] Measurement has also recently been carried out by microCT.[34,44,45]
- By digitising the intaglio surface of the crowns and master preparation and merging these images in best-fitting alignment, and then measuring the difference at specific points;[20] or by laser videography to digitise the surfaces.[17]

Gassino *et al,.* (2004),[46] determined that in order to accurately assess the marginal gap,[20] measurements spread evenly around the circumference of the preparation were required.

The internal fit of dental crowns has been measured by similar methods, for example:

- As stated above, combined high and low viscosity silicone is sectioned and the thickness of the low viscosity material measured either directly or by the use of photographs
- Similarly, the cementation techniques mentioned above can be used to measure the internal fit
- A measurement of the total internal fit, rather than at specific points, has been made by luting the crown with a low viscosity silicone, and then using the weight and density of that silicone to relate this to the surface area of the preparation.[47]

The advent of CAD/CAM restorations over the last few decades has resulted in the development of a variety of new materials for the use of full coverage crowns, and whilst many materials have been tested for internal fit and marginal gap, some of the more recent materials do not appear to have been tested. Different manufacturers have recommended different luting gaps and there appears to be no consistency in this.[48]

Whilst zirconia has been tested for marginal gap and internal fit, the only study to determine the overall fit using a luting agent, was not carried out using zirconia. Enamic, an interpenetrating network ceramic, Brilliant Crios, a composite, have not been tested for marginal gap and internal fit. Therefore, the purpose of this study was to

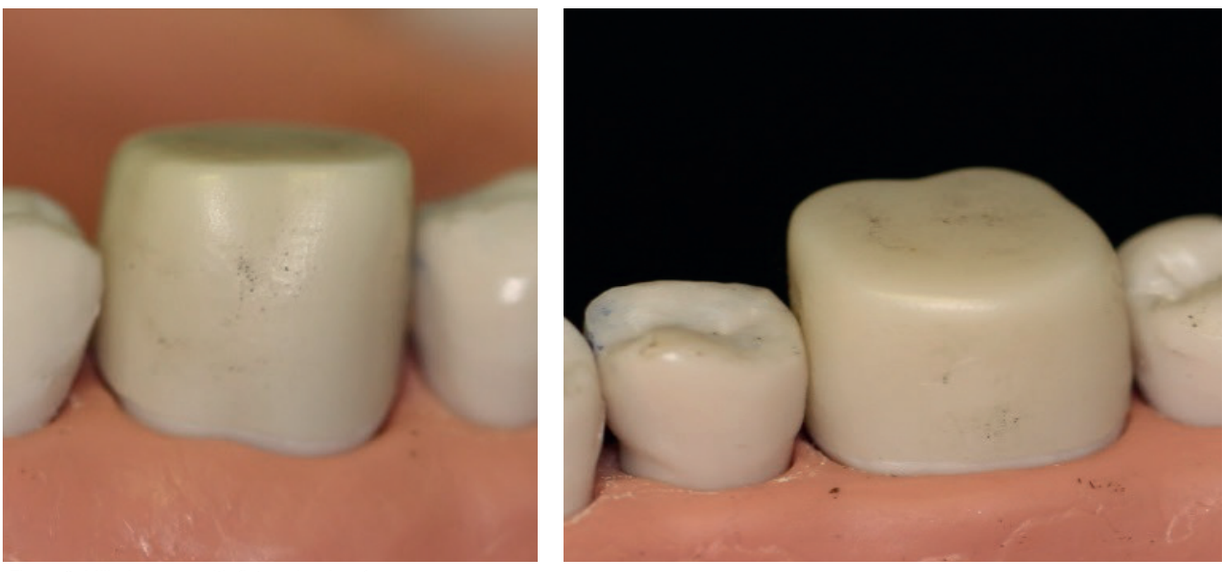

Figure 2. Milled crowns with flat occlusal surface.

compare the marginal gap and total internal fit of single CAD/CAM created crowns using Enamic (Vita, Austria), Zirconia (Vita, Austria), and Brilliant Crios (Coltene, Switzerland).

METHODS AND MATERIALS

Tooth Preparation

An acrylic resin typodont mandibular first molar resin tooth was prepared to produce a standardised crown preparation with a total convergence angle of 12 degrees, (as measured digitally from the scanned image) internally rounded shoulder margins of 1.5mm circumferentially, and an occlusal reduction of 1.5mm. All line angles were rounded (Fig 1).

Scanning and milling

The preparation was scanned and imaged with the Omnicam intra-oral scanner (Dentsply Sirona, Germany). The scanned file was used to determine the total surface area of the preparation using FEA software (Solidworks® Dassualt Systèmes Solidworks Corp. Massachusetts, USA). A crown with a flat occlusal surface was designed (Fig. 2) and the same design was used for all crowns. This was so that a constant load could be placed on the crown with a 3kg weight in an axial direction. The crowns were milled with either a luting space of 100µm or 200µm. The MC X5 milling machine (Dentsply/Sirona, Germany) was used to mill all crowns. The materials used were Enamic (Vita, Austria), Zirconia (Vita, Austria), and Brilliant Crios (Coltene, Switzerland).

Statistical Analysis and Sample Size

Marginal gaps of greater than 120µm would be considered the limit of clinical acceptability. Given an expected mean marginal gap of 110µm for any group, and aiming to detect a difference of more than 20% from this, given a within-group relative standard deviation of 22% (which corresponds to an effect size of d = 0.83), 80% power and the 5% significance level, a total sample size of 24, i.e. 4 per group, would be required.[49] It was decided, however, to use 5 per group as the expected mean gap may differ from the above. In addition, the milling of 5 crowns would not affect the wear of the burs and therefore this would not be a confounding factor.

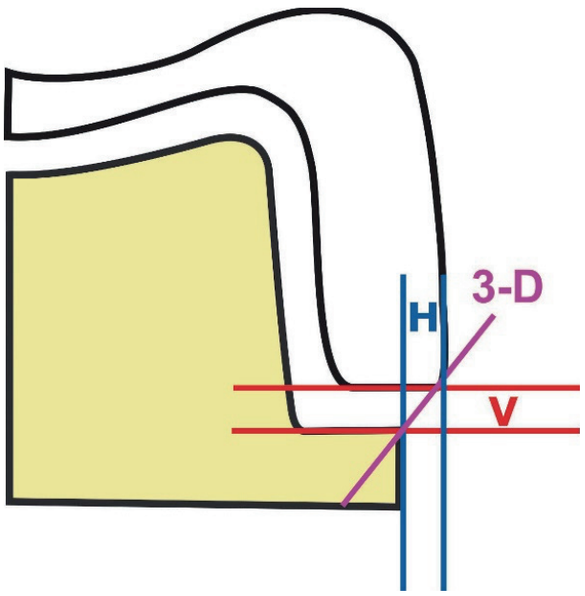

Figure 3 Two-dimensional measurement only records the vertical height (V) but does not take into account any overlap (either positive or negative), hence the 3-dimensional measurement (3-D) is a more realistic representation of the marginal gap.

Categorical variables were summarised and illustrated by means of bar charts. Continuous variables were summarised by the mean, standard deviation, median and interquartile range, and their distribution illustrated by means of histograms. The effect of material and internal space on the marginal gap required a two-way Analysis of Variance (ANOVA) with the mean marginal gap measured at 20 points around the circumference of the preparation as the dependent variable,[46] and material (Zirconia/ Brilliant Crios/ Enamic) and internal space difference (200µm and 100µm), and their interaction, as the independent variables. Outliers were removed, or data transformations were applied as necessary. *Post-hoc* tests were carried out to determine the material-luting space combinations which had the smallest values for the outcomes. The Tukey-Kramer adjustment for unequal group sizes (to allow for the deletion of outliers) was used, and effect sizes were expressed using Cohen's kappa. Comparison of the marginal gap between matching 2D and 3D measurements (for without-silicone and with-silicone measurements) was done using the paired samples t-test. The proportion of crowns which failed to meet the marginal gap limit of 120µm were to be compared between groups using Fisher's exact test. Test-retest reliability for the continuous outcomes was determined using the Intra-class Correlation Coefficient (ICC). Test-retest reliability for whether or not the marginal gap exceeded 120µm was determined by Cohen's kappa. Data analysis was carried out using SAS version 9.4 for Windows. The 5% significance level was used.

Marginal Gap Measurement

The crowns were first seated onto the master preparation without cementation and the marginal gap (if any) was measured using a Reflex Microscope (Reflex Measurement Ltd., Cambridge, UK), which measures in three dimensions to an accuracy of 4µm. The marginal gap was measured at 20 equi-distant points around the circumference of the crown. Each point was marked 1mm below the margin of the preparation with a bur.

Each crown in turn was filled with light-body polyvinyl siloxane impression material (Express, 3MESPE, Germany), and seated onto the prepared tooth under a constant load for 10 minutes, using a 3kg weight placed on the flat occlusal surface of the crown. After setting, the excess material was removed from the circumference of the crown using a scalpel blade. The marginal gap was then measured using the same 20 measuring points, with the reflex microscope. Because the reflex microscope measures in 3 dimensions, the data points are manipulated in the software to provide measurements in both 2 and 3 dimensions (Fig 3).

Total Internal Fit Measurement

The silicone film was removed and weighed using an electronic scale to calculate its weight. The overall thickness of the silicone represented the total internal gap, calculated using the following equation after Grey et al (1993): [47]

$$\text{Thickness (internal gap)} = \frac{\text{weight}}{(\text{surface area} \times \text{density})}$$

The surface area of the preparation was 183.84mm^2 using a stereolithography generated mesh. The density of the 3M light-body polyvinyl siloxane impression material is 1.29g/ml.

MILLED SPACE		CRIOS		ENAMIC		ZIRCONIA	
		NS	S	NS	S	NS	S
100µm	Mean	0.0245	0.0277	0.0250	0.0273	0.0246	0.0277
	Std Dev	0.0007	0.0006	0.0005	0.0011	0.0011	0.0015
200µm	Mean	0.0200	0.0239	0.0222	0.0288	0.0200	0.0259
	Std Dev	0.0012	0.0009	0.0011	0.0013	0.0011	0.0012

Table 1: Mean and the Standard deviations of the 2D marginal gaps (in mm) between Crios, Enamic and Zirconia measured at the 100 and 200 µm milled spaces with (S) and without (NS) silicone.

RESULTS

Measurement consistency

During initial training in the use of the reflex microscope, it was observed that the researcher had some difficulty with locating the virtual point of light, especially on the z-axis, and so the entire experiment was repeated 3 times on 3 different occasions, in order to assess measurement consistency.

The averaged marginal gap measurements from two of the occasions that had the highest reliability across all the outcomes were used for further analysis. The average within-group relative standard deviation for the marginal gap outcomes (4.0%) was considerably lower (5.5 times) than the relative standard deviation of 22% used in the sample size calculations, confirming the validity of the sample size and the power of the analyses. There was excellent agreement between the three internal fit measurements on all occasions.

Two-dimensional measurements of the marginal gap

Table 1 shows the 2D measurements of the three different materials with and without silicone.

Statistically significantly differences were found between the materials both without ($p < 0.0031$) and with ($p = 0.0008$) silicone. The marginal gaps when no silicone was applied between the three materials were statistically significantly different ($p < 0.0031$), as it was with the silicone ($p = 0.0008$). In addition, the marginal gap between the three materials was significantly smaller ($p < 0.0001$ with no silicone, $p = 0.0028$ with silicone) when the luting space of 200µm was used, compared with 100µm. With the silicone, Crios 200µm and Zirconia 200µm had the smallest marginal gaps compared with all the other experimental combinations.

Three-dimensional measurements of the marginal gap

Table 2 shows the 3D measurements of the three different materials with and without silicone.

There were no statistically significant differences in the marginal gaps between the three materials with and without silicone ($p = 0.43$ without silicon, $p = 0.55$ with silicone). The marginal gaps both with and without silicone were significantly smaller ($P < 0.0001$) when the luting space of 200µm was compared with 100µm. There were no significant interactions ($p = 0.60$ without silicone, $p = 0.83$ with silicone) between the materials and the luting space. All three materials at 20µm had the smallest marginal gap compared with the other experimental combinations.

Internal Fit

Table 3 shows the internal fit measurements of the three different materials at the 100 and 200µm milled spaces.

Post-hoc tests revealed that the mean internal fit was significantly higher for the 200µm luting space than for the 100µm luting space for each material. For the 100µm experiments, the mean fit for Zirconia was significantly higher than that for Crios and Enamic. Crios 100µm and Enamic 100µm had the smallest internal fit compared to all the other experimental combinations.

Comparison of matching 2D and 3D measurements

When measuring the marginal gap with no silicone, the 3D measurements were an average of 10.9µm higher than the corresponding 2D measurements (95% confidence interval: 0.0103-0.0114mm; $p < 0.0001$). With silicone, the 3D measurements were an average of 10µm higher than the corresponding 2D measurements (95% confidence interval: 0.0093-0.0107 mm; $p<0.0001$).

MILLED SPACE		CRIOS		ENAMIC		ZIRCONIA	
		NS	S	NS	S	NS	S
100µm	Mean	0.0355	0.0376	0.0357	0.0377	0.0359	0.0385
	Std Dev	0.0009	0.0015	0.0017	0.0009	0.0011	0.0012
200µm	Mean	0.0325	0.0349	0.0317	0.0363	0.0331	0.0363
	Std Dev	0.0018	0.0023	0.0011	0.0006	0.0013	0.0019

Table 2: Mean and Standard deviations of the 3D marginal gaps between Crios, Enamic and Zirconia measured at the 100 and 200 µm milled spaces with (S) and without (NS) silicone.

MILLED SPACE		CRIOS	ENAMIC	ZIRCONIA
100µm	Mean	0.0012	0.0013	0.0016
	Std Dev	0.0001	0.0001	0.0001
200µm	Mean	0.0021	0.0021	0.0021
	Std Dev	0.0000	0.0001	0.0001

Table 10: Mean and Standard deviations of the internal fit for Crios, Enamic and Zirconia measured at the 100 and 200 µm milled spaces.

DISCUSSION

This is the first study to compare the marginal gap and internal fit of CAD/CAM full coverage crowns measured in two and three dimensions, and using different luting spaces (100µm and 200µm).

Marginal Gap

It is generally accepted that a marginal gap of less than 120µm is clinically acceptable but a large variety of values for marginal gaps has been reported. The present study used a three-dimensional measurement method, and the differences between the 2D and 3D measurements were statistically significant, being on average 10µm higher for the 3D measurements. This is therefore a more accurate indication of the amount of luting material to be found at the margin after cementation.

Measuring the marginal gap of cemented or un-cemented crowns can influence the results of the measurement. 50-53 Marginal gap measurements generally increase following cementation;[54,55] and the medium for cementing the crown might not facilitate complete seating, resulting in an inadequately closed margin.[56] In the current study, all the measurements that were conducted on the specimens cemented with silicone were higher than those cemented without silicone.

The average 2D marginal gap without silicone was 24.7µm for the 100µm luting space, and 20µm for the 200µm luting space. After luting with silicone the average was 27.5µm for the 100µm luting space (a difference of 2.8µm), and 26.2µm for the 200µm luting space (a difference of 6.2µm).

The average 3D marginal gap without silicone was 37.5µm for the 100µm luting space, and 32.5µm for the 200µm luting space. The averages after luting with silicone were 37.9µm for the 100µm luting space (a difference of 0.4µm), and 36.2µm for the 200µm luting space (a difference of 3.7µm).

Although there were differences between the materials in these measurements, all the marginal gaps were well within the clinically acceptable limits.

Internal Fit

An acceptable practical guide for cement films has been suggested as being between 50 and 100µm.[57] Many previous studies have not been carried out on milled crowns, and the luting space used has been somewhat arbitrary, using methods such as painting die-spacer on dies to be used for cast restorations. In CAD/CAM, however, the luting space can be defined and is dependent on the milling parameters set in the software. Therefore, this study set out to determine any relationship between the luting space and the marginal gap.

Although internal fit is thought not to be as clinically relevant as the marginal fit, 5,53 it is of importance as it affects the resilience of the crown.[34] The proper internal fit of the crown is also critical as it enables the seating of the crown while allowing for both retention and resistance.[24] In addition, cementation techniques such as uncontrolled finger pressure or overfilling of the crown with cement, might lead to an uneven flow of cement with one axial wall having a thick film and the opposite wall having a thin film.[58] It has also recently been shown that with a larger internal luting space it is possible to seat the crown off-axis, resulting in a wider marginal gap on one side of the crown.[59]

For the 100µm luting space the smallest internal fit was recorded by Crios at 1.2µm followed by Enamic 1.3µm, and Zirconia at 1.6µm. For the 200µm luting space the internal fit of the three materials was at the same value of 2.1µm. All of these measurements are well within acceptable clinical limits.

The results in this study showed that all marginal gaps were clinically acceptable, and in light of the danger of incorrect seating of the crown at the 200µm luting space,[59] it may be advisable to mill at a 100µm luting space for full crowns.

5.3. Limitations

This study used only three materials, but these were considered representative of crowns with different hardness, as this might affect the milling precision. The use of the reflex microscope held some challenges for the researcher, as it requires precise binocular vision. However, by repeating the measurements three times, sufficient reliability was obtained, and this should become a standard procedure when using measuring instruments of this precision. Finally, the cementing medium was a proxy for actual luting cements, and therefore the results may not apply to different luting cements, which should be the subject of further study. In addition, the milling parameters of different CAD/CAM systems may influence the marginal gap as one study did find a difference between the two systems tested. 60

CONCLUSION

Within the limitations of this study, all crowns milled, regardless of the luting space used, provided excellent marginal and internal fit, well within clinically acceptable parameters. The 3D measurements are more clinically relevant than 2D measurements and were always significantly larger, but on average only by an additional 10 µm. The smallest marginal gaps were found in the crowns milled with a 200 µm luting space, however this can present problems with non-axial seating and so it may be advisable to use the 100 µm luting space parameter.

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Factors that affected the efficacy of non-surgical periodontal treatment carried out by postgraduate periodontology students

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ABSTRACT

Background

The training of postgraduate students in periodontology has a significant clinical impact. The overall assessment of the efficacy of non-surgical treatment of periodontitis, has value to inform training protocols as well as assess the quality of clinical service delivery. Furthermore, obstacles to successful treatment can be identified.

Aim

The aim of the study was to determine the effectiveness of non-surgical periodontal treatment, as well as the factors that may determine treatment outcome at the postgraduate clinic in the Periodontology Department at the University of the Western Cape, Tygerberg Dental Hospital, between 2016 and 2018.

Methods

A cross-sectional record-based study of 100 patients was conducted. Demographic, social, clinical, treatment data were obtained from the hospital files. Periodontal parameters including bleeding index (BI), Pocket Probing depth (PPD), Plaque index (PI), and clinical attachment level (CAL), were recorded at the initial visit (Pre-treatment) and follow-up visits (Post-treatment), and the final treatment outcomes were calculated based on the differences of these parameters' values between the initial visit and the last follow-up visit. Data were presented as mean and range for continuous variables and as a frequency for categorical variables. Statistical analyses were performed to determine if there was a relationship between the varied factors and treatment outcome with $p < 0.05$ as statistically significant.

Results

The results showed that all 100 patients demonstrated a marked reduction in PPD, PI, BI, and loss of CAL. The overall mean PPD reduction was 0.32 (0.5), the mean reduction in PI and BI were 37.2 (24.08) and 34.61 (22.78), respectively, and the mean clinical attachment gain was 0.42 (0.97) mm. Treatment outcome showed no difference in PPD, PI, BI, and CAL between females, smokers, and patients with systemic conditions compared to males, non-smokers, and patients without systemic conditions. On the other hand, patients who underwent more maintenance treatment visits over a period longer than 2 months duration had significantly better outcomes compared to patients who had less than two months of duration of treatment.

Conclusion

This study proved the effectiveness of the non-surgical surgical periodontal treatment at the postgraduate periodontal clinic. Treatment duration and frequency of recall visits were the most influential factor impacting the treatment outcome.

Keywords

Periodontal disease.
Periodontitis.
Non-surgical Periodontal therapy.
Treatment efficacy.
Treatment outcome.
Postgraduate Students.
Tygerberg Dental Hospital.
Influential factors.

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Co Supervisor:	Dr. M.T.Peck	10%
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INTRODUCTION

Periodontal disease is the sixth most prevalent disease globally[1,2,3,4]. A new classification of periodontal disease was proposed in June 2018 based on the World Workshop on Classification of Periodontal and Peri-Implant Diseases and Conditions held in Chicago in November 2017. According to the pathophysiology, this workshop classified periodontal disease into three categories: necrotizing periodontitis, periodontitis as a manifestation of a systemic disease, and periodontitis. Periodontitis is further characterized by the

staging and grading system that relies on the severity of the disease and the rate of disease progression, respectively.[5]

Investigations have shown that periodontitis is linked to over 50 systemic diseases and conditions.[6] Although no clear causative association has been established, it has been found that periodontal therapy is not only crucial for maintaining proper oral health, but can also improve the overall systemic health of periodontally involved individuals.[7] Periodontal therapy aims to restore the natural dentition, periodontium, and peri-implant tissue, as well as to restore function, aesthetics, health, and comfort.[8] Generally, there are four phases associated with periodontal therapy: the systemic phase, the initial non-surgical phase, the constructive surgical phase, and the supportive periodontal phase. The initial non-surgical phase is the most critical component of periodontal therapy with the main objective to reduce or eliminate gingival inflammation.[9]

Treatment outcome is the evaluation carried out to assess the results of treatment to determine the efficiency, effectiveness, safety, and practicability of the treatment in each case.[10] The American Academy of Periodontology reported the desired outcome of periodontal therapy as a significant resolution of clinical signs of gingival inflammation, reduction of pocket depths, clinical attachment gains (or at least stabilization of the attachment level), and the progress toward reduction of plaque to a level compatible with gingival health.[11] Periodontal treatment outcome is considered clinically successful with the absence of pocket depth (≥ 5mm) and bleeding on probing of ≤ 15%. The treatment outcome is defined as beneficial when the mean clinical attachment level and the mean probing pocket depth outcomes were improved.[12,13]

The aim of the study was to determine the effectiveness of non-surgical periodontal treatment, as well as the factors that affected the clinical outcome at the postgraduate clinic in the Periodontology Department at the University of the Western Cape, Tygerberg Dental Hospital, between 2016 and 2018.

MATERIALS AND METHODS

The present study was an analytic, cross-sectional, record-based study of patients who had visited the postgraduate clinic at the Periodontal Department at Tygerberg Dental Hospital between 2016 and 2018 for the treatment of periodontitis. The study was approved by the the Biomedical Research Ethics Committee of the University of the Western Cape (Ethics Reference Number: BM19/2/6).

Inclusion criteria were patients between 18 and 80 years, patients diagnosed with periodontitis, patients treated by a postgraduate student, and patients who had follow-up visits. Exclusion criteria were patients who had no record of follow-up visit, pregnant women or breastfeeding mothers, and patients with missing data.

Data collection

More than 700 files for patients treated by different students at the postgraduate department during the years 2016-2018, were analyzed. This study included a convenient sample of 100 patients who met the inclusion criteria. Patient data were obtained from the hospital files. Age, sex, smoking history and medical history were acquired from the patient profiles. In addition, treatment data such as type of treatment provided, whether chlorhexidine mouthwash has been prescribed, and treatment duration were also obtained. Furthermore, the periodontal parameters data were also extracted. These include (BI), (PPD), and (PI). These parameters were recorded at six sites per tooth (mesiobuccal, mid buccal, distobuccal, mesiolingual, mid lingual, and distolingual). In addition to that (CAL), which was measured by the distance from the cementoenamel junction to the base of the periodontal pocket was also obtained. The mean values of all these parameters were recorded at the initial visit (Pre-treatment) and follow-up visits (post-treatment), and the final treatment outcomes were calculated based on the differences of these parameters' values between the initial visit and the last follow-up visit.

Statistical analysis

Statistical analysis was performed using Stata Corp (2017) Stata Statistical Software: Release 15. College Station, TX: StataCorp LLC. Data were presented as mean and range for continuous variables and as a frequency for categorical variables. Statistical analyses were performed using a t-test to determine if there was a relation between the varied factors and treatment outcome. A P-value of $p < 0.05$ was considered statistically significant.

RESULTS

The study population consisted of 100 patients with periodontitis. The patients' mean age was 51.1 (23.24) years old (range 22-81 years). The sample consisted of 48 males and 52 females with a ratio of 0.9:1. Smoking history was present in 70 patients. Systemic conditions were present in 53 patients (26 patients with diabetes mellites, 6 patients with HIV, and 21 patients with other conditions). The overall mean PPD reduction was 0.31 (0.4),

Table 1: The relationship between patient-related factors and treatment outcome

Clinical Parameters	Sex		*p*-value	Smoking Status		*p*-value	Presence of Systemic Conditions		*p*-value	Treatment Duration		*p*-value
	Male	Female		Smoker	Non-smoker		SD	Non-SD		<2 months	>=2 months	
PD	0.25 (0.4)	0.38 (0.5)	0.147	0.23 (0.3)	0.36 (0.5)	0.210	0.38 (0.6)	0.25 (0.3)	0.161	0.102 (0.2)	0.532 (0.6)	< 0.001
PI	35.33 (23.6)	38.92 (24.6)	0.459	39.23 (22.1)	36.33 (24.9)	0.583	41.32 (24.2)	32.55 (23.4)	0.069	31.12 (19.7)	43.28 (26.6)	0.011
BI	33.81 (22.7)	35.35 (22.9)	0.738	36.2 (4.2)	33.93 (22.8)	0.650	33.5 (22.6)	35.83 (23.1)	0.616	25.28 (19.1)	43.94 (22.5)	< 0.001
CAL	0.46 (1.3)	0.38 (0.6)	0.682	0.31 \ (0.4)	0.47 (1.1)	0.448	0.56 (1.3)	0.26 (0.4)	0.122	0.102 (0.2)	0.744 (1.3)	0.0007

PD, Probing Depth; PI, Plaque index; BI, Bleeding Index, CAL, Clinical Attachment level

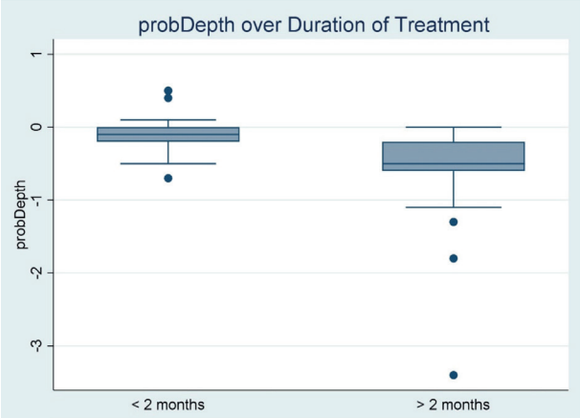

Figure 1:Comparison of the treatment outcome of probing depth for patients who were treated for less than 2 months compared to patients who were treated for more than 2 months.

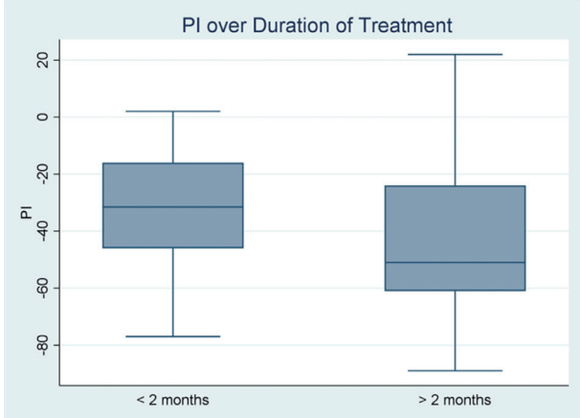

Figure 2: Comparison of the treatment outcome of plaque index for patients who were treated for less than 2 months compared to patients who were treated for more than 2 months.

the mean reduction in PI and BI were 37.2 (24.08) and 34.61 (22.78), respectively, and the mean clinical attachment gain was 0.42 (0.97)mm. Treatment outcome showed greater decrease in PPD, PI, and BI, as well as greater increase in CAL in females, smokers, and patients with systemic conditions compared to males, non-smoker, and patients without systemic conditions. However, this finding was not statistically significant. Results are shown in Table 1.

Results also showed that as the number of dental visits increased by 1 visit, the probing depths decreased by -0.37 units, the plaque index decreased by -0.414 units and the CAL increased by 0.038 units. However, these findings were statistically insignificant.

All patients were given oral hygiene instructions (OHI) and chlorhexidine (CHX) prescriptions. Ninety six percent (96 patients) were treated with scaling and root planing, while only 4% (4 patients) were treated with scaling only. Antibiotics were prescribed for 28% (28 patients). Fifty percent (50 patients) were treated for more than two months and 50% (50 patients) were treated for less than 2 months. Treatment outcome showed a greater decrease in PPD, PI, BI, as well as increase in CAL in patients who underwent more than 2 months of treatment compared to patients who had less than two months of treatment. This finding was statistically significant. Results are shown in Figures 1-4.

DISCUSSION

The goal of the current study was to determine the effectiveness of non-surgical periodontal treatment, as well as the factors that affect this efficacy. Although not statistically significant, this study showed that all patients demonstrated a marked reduction in PPD, PI, BI and an increase in the CAL. The overall mean PPD reduction was 0.31 (0.4), the mean reduction in PI and BI were 37.2 (24.08) and 34.61 (22.78), respectively, and the mean clinical attachment gain was 0.42 (0.97) mm. In a study with a large Chinese population that included 10,789 patients, the overall mean PPD reduction was 0.6mm.[14] Cobb *et al,.* reported that the mean PPD reduction for pockets was 1.29 mm, with a net gain in clinical attachment level of 0.55 mm.[15]

Patient-related factors

Males had higher pre-treatment PPD, PI, BI and clinical attachment loss compared to females. However, only CAL was statistically significant. This proposes that females had better oral hygiene behavior than males. This result conforms to several studies conducted in the past decades that compared oral hygiene behavior between males and females. Strauss *et al.,* also found that females practice daily interdental cleaning more often than men.[16] However, in the present study improvement in the periodontal parameters after treatment in both males and females were observed,

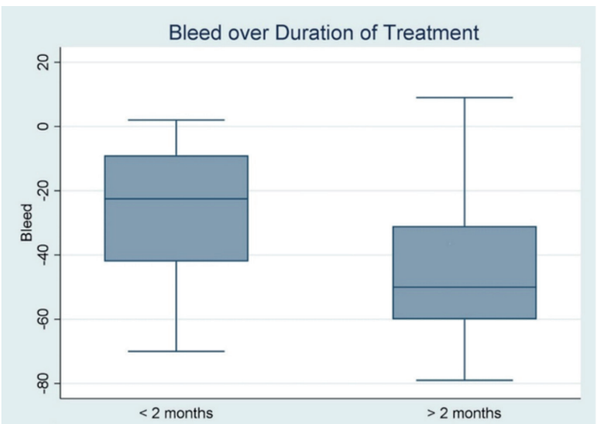

Figure 3: Comparison of the treatment outcome of bleeding index for patients who were treated for less than 2 months compared to patients who were treated for more than 2 months.

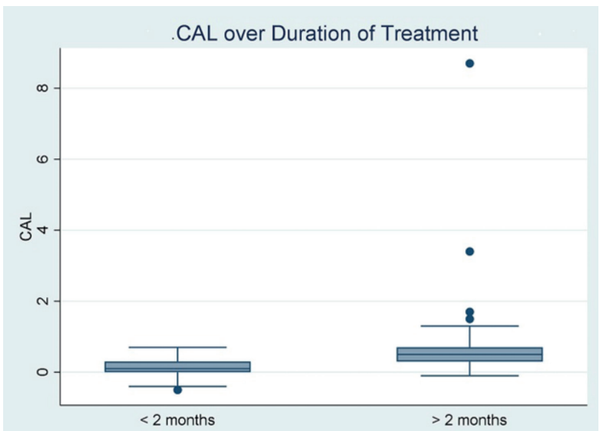

Figure 4: Comparison of the treatment outcome of the clinical attachment level for patients who were treated for less than 2 months compared to patients who were treated for more than 2 months.

however, the effectiveness of treatment was not affected by sex factor.

Smokers had a higher pre-treatment PPD, PI, BI, and clinical attachment loss compared to non-smokers. Although, none of these findings were statistically significant. This finding is similar to a cross-sectional study in India, which evaluated the periodontal health status among cigarette smokers and non-smokers. The study showed that deep pockets of ≥ 6mm were found in 41% of smokers and 26% of non-smokers, and the difference between the two groups was statistically significant.[17] Petrovic *et al.,* found a statistically higher plaque index in smokers compared to non-smoker.[18] Haffajee *et al.,* also found that current smokers had greater attachment loss than past smokers or those who never smoked.[19] Smoking status did not significantly affect treatment outcome in this population.

Patients with systemic conditions had a higher pre-treatment pocket depth and plaque index compared to patients without systemic conditions. Several studies support the relationship between systemic diseases and periodontal disease. A study in Sweden found that the prevalence of periodontal pockets ≥ 5mm was associated with established hypertension or high blood pressure readings,[20] while Botero et al., found that patients with both periodontitis and diabetes mellitus have greater clinical attachment loss than non-diabetic periodontitis patients.[21]

The findings of this study revealed that the improvement in BI, PI and CAL was not affected by the medical condition of the patient. However, the mean PPD was different between participants with and without a systemic condition at base line.

Treatment-related factors

The present study found that treatment duration of more than two months was more beneficial in reducing PPD, PI, and BI, as well as increasing CAL compared to treatment of less than two months duration. This finding is in agreement with a study conducted in Israel in 2003 which evaluated probing pocket depth changes following 2 years of periodontal maintenance therapy. The study included 595 patients, whereby all participants showed a continuous decrease in pocket depth of 0.95 over the 2 year.[22] A similar outcome was reported in a study that examined periodontal and dental conditions in individuals after periodontal therapy in private practice in Geneva. They found that longer treatment duration (i.e., the more frequent the recall visits), was associated with a greater reduction in probing pocket depth (23). Worth mentioning is the duration of treatment and frequency of periodontal maintenance visits, which may reflect the patient compliance and dedication to treatment, as patients with longer duration of treatment are usually more dedicated to their periodontal treatment, which positively impacts the periodontal treatment outcome.[24, 25]

The main limitations of this study were that the study was file-based, which made it inherently vulnerable to bias, as well as the relatively limited sample size, which influenced the statistical significance.

CONCLUSION

This is the first reported study of its kind to investigate the periodontal treatment outcome in a local South African dental hospital, which confirmed the effectiveness of non-surgical periodontal treatment in the Postgraduate Periodontal Clinic at Tygerberg Dental Hospital. The overall reduction in PPD, BI, PI, and clinical attachment gain was reported in all patients. The most significant factor to impact treatment outcome is treatment duration and frequency of recall visits; greater success is achieved if treatment is rendered over more than two months with increased frequency of recall visits.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest nor any financial interest in this study. Furthermore, we declare that the study does not have any commercial value and is done purely to add to the current pool of knowledge.

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Hard tissue characteristics of patients with bimaxillary protrusion

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ABSTRACT

Introduction

Bimaxillary protrusion (BP) is a common developmental condition amongst the South African Black population characterized by proclined incisors with resultant procumbency of the lips.

Aims

The aim of this study was to perform a cephalometric radiographic analysis of the pre-treatment dental and skeletal structures in a sample of Black South Africans in order to identify the characteristic features of BP in this race group and compare them to norms.

Materials and methods

Records of 67 South African Black patients divided into 28 males and 39 females with a mean age of 17.8 years, clinically diagnosed with BP were included in the study. Cephalometric parameters were hand traced on lateral cephalometric radiographs and measurements recorded for evaluation and comparison to norm values used for this population group to determine the features that both males and females present with.

Results

Characteristic pre-treatment dental features of the sample included maxillary incisors that were proclined and protruded with resultant decreased interincisal angle, mandibular incisors which were favourably positioned. Skeletal features included retrognathic jaws (maxilla to a greater degree) resulting in a mild to moderate Class III skeletal pattern but with females exhibiting a smaller ANB angle indicating a greater tendency for a Class III skeletal pattern. The skeletal growth pattern was vertically directed with an average anterior facial height ratio.

Conclusion

The findings indicate that most BP patients in this South African Black population presented with dentoalveolar protrusion, retrognathic jaws and a mild to moderate skeletal Class III pattern.

Keywords

Bimaxillary protrusion, Black South Africans, facial profile, facial aesthetics

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INTRODUCTION

Bimaxillary Protrusion (BP) is a well reported form of malocclusion characterised by protrusive incisors with resultant protrusion of the lips. As a result of the anaesthetic facial appearance brought about by this increased procumbency, many people seek orthodontic care in order to reduce this procumbency.[1,2,3] A review of the literature reveals that grey areas exist regarding the diagnosis of bimaxillary protrusion. It is not clear whether the facial protrusion is solely due to incisor proclination, protrusion or both and whether there is also involvement of the dentoalveolar bases.[4]

Culture, ethnicity, society as well as personal preferences all play an important role in determining whether individuals will seek orthodontic treatment or not. The interpretation of the many published studies performed on the Caucasian5 and African American populations[6,7] must be done with caution as they may not be applicable in a South African population, comprising of ethnic groups that differ in cultural and social dictums. Beukes, Dawjee and Hlongwa[8] and Dawjee, Becker and Hlongwa[9] determined what Black South Africans regard as a pleasing and acceptable facial profile. It was determined that the need for therapeutic intervention was dependent on the severity of the incisor protrusion, the ability of the patient to close the lips without strain and the patients desire to modify their appearance.

The aim of the study was to perform cephalometric radiographic analyses of dental and skeletal structures of a sample of South African patients presenting with BP in order to identify characteristic features.

METHODOLOGY

Sample size and selection

The research project was approved by the Sefako Makgatho University Research Ethics Committee (SMUREC) prior to commencement (Protocol number: SMUREC/D/125/2018: PG).

This was a descriptive retrospective record-based study. The sample consisted of 67 patients divided into 28 males and 39 females with a mean age of 17.8 years. The sample size was found to be sufficient according to the Central Limit Theorem and comparative analysis of similar published studies.[10,11] The study population consisted of individuals who visited the department of orthodontics

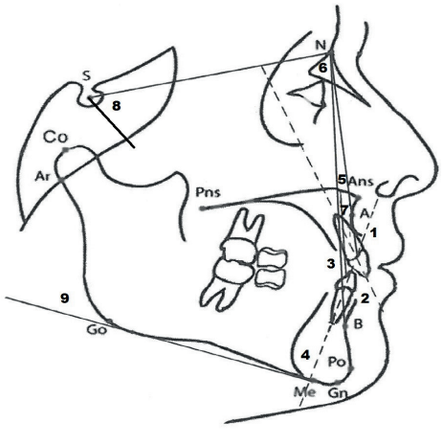

Figure 1: Angular measurements 1) UI-NA, 2) LI-NB, 3) UI-LI, 4) LI-MP, 5) SNA, 6) SNB, 7) ANB, 8) Y-Axis, 9) SN-MND

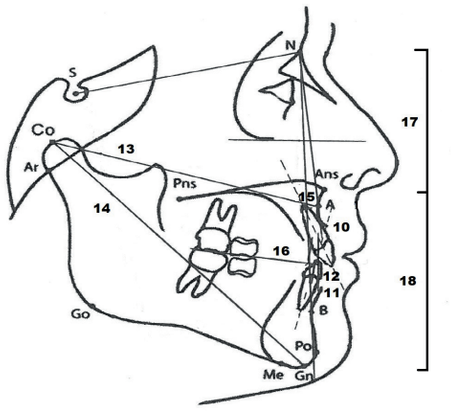

Figure 2: Linear measurements 10) UI-NA, 11) LI-NB, 12) LI-APg, 13) CO-A, 14) CO-GN, 15) Convexity, 16) WITS, 17) UFH, 18) LFH

at the Sefako Makgatho Health Sciences University and were clinically diagnosed with bimaxillary protrusion. These were patients who presented with varying degrees of lip separation at rest, mentalis strain, gummy smile or anterior open bites. Standard pre-treatment lateral cephalometric records of patients treated from 1 January 2015 to 31 December 2020 were visually assessed by the principal researcher and again re-assessed by the supervisor and only those of superior diagnostic quality were selected for the study. Lateral cephalometric radiographs of patients with craniofacial abnormalities, a history of trauma, prior orthodontic treatment, orthognathic or cosmetic surgery were excluded from the study.

Cephalometric analysis

A standardized method of cephalometric measurement using a fine-point 4H pencil and lead acetate paper was carried out by the researcher. All lateral cephalograms were traced as shown in (Figures 1 & 2) and parameters indicated (Table I) were measured. Intra-reliability measurement test was performed by the principal researcher as well as an inter-reliability test by the supervisor at two different time intervals where 10 lateral cephalograms were chosen at random and were re-traced and re-measured to determine the reliability of data. Strict adherence to inclusion and exclusion criteria was adhered to in order to avoid sampling bias. Measurement bias was minimised by tracing no more than 10 cephalograms at a time to avoid operator fatigue.

Statistical analysis

All statistical analyses were performed on the SAS (SAS Institute Inc. Carey. NC, USA), release 9.4 running under Microsoft Windows. All statistical tests were two-sided and p values ≤ 0.05 were considered significant. Where

Table I: Dental measurements used for analysis

Parameter	Description
	Linear
UI-NA	Relative position of maxillary incisor teeth to the N-A line
LI-NB	Relative position of mandibular incisor teeth to the N-B line
LI- APg	Relative position of mandibular incisor teeth to the A-Pg line
	Angular
UI-NA	Relative angular relationship of maxillary incisor teeth
LI-NB	Relative angular relationship of mandibular incisor teeth
UI-LI	Angle between the maxillary and mandibular incisor axis posteriorly
LI-MP	Relative angular relationship of mandibular incisor teeth

Skeletal measurements used for analysis

Parameter	Description
	Linear
CO-A	Effective midface length (McNamara)
CO-GN	Effective mandibular length (McNamara)
WITS	Linear distance between projection on point A & Point B on the functional occlusal plane
Convexity	Distance from point A at 90 degrees to N-Pg line
LFH	Vertical distance from ANS to Menton
	Angular
SNA	Anteroposterior position of maxilla
SNB	Anteroposterior position of mandible
ANB	Differences between SNA and SNB
Y-Axis	Direction of growth
SN-MND	Vertical relationship of the mandible

applicable, measurements from the study were compared to normative values (Table II) using the t-test from relevant literature sources.

The data analysis included comparisons of gender and race, and comparisons of subgroups of patients was performed if there was any clinical interest. Where applicable 95% confidence intervals were calculated.

RESULTS

Characteristic features of bimaxillary protrusion

Table III illustrates the differences in the dental and skeletal variables in a sample of South African black patients with BP when compared to the established norms.

Dental analysis revealed maxillary incisor protrusion (UI-NA: 10.3 ±3.19 mm) and proclination (UI-NA: 30.8±8.12°). The lower incisors displayed no significant difference from the accepted norms in terms of both their linear (LI-NB: 37.7±7.17mm; LI-Apg: 8.1±2.65mm) and angular positions (LI-NB: 37.7 ±7.17°; LI-MP: 99.0±13.75°). The maxillary and mandibular incisors demonstrated proclination in relation to each other (UI-LI: 107.7±11.98°).

Skeletal characteristics showed a decrease in both the effective midfacial length (CO-A: 83.4±5.21mm) and effective mandibular length (CO-GN: 107.3±5.92mm). The sagittal positional relationship of both the maxilla and mandible in relation to the cranial base was retrognathic (SNA: 82.7±4.90°) (SNB: 78.3±3.86°), with an ANB angle which was decreased (4.2 ±2.87°; p= 0.03), indicating a mild Class III skeletal pattern. In relation to the norm values, the convexity (convexity: 4.3 ±2.46mm) and the WITS values (WITS: -2.9±3.91mm) displayed no statistical differences within the BP sample.

In terms of the vertical relationships the sample exhibited a slight vertical growth pattern according to the Downs analysis (Y-Axis: 70.9±4.43°) with a slight decrease in both the UFH and LFH (UFH: 46.3±3.61mm); LFH: 66.1±5.15mm), although in a ratio which is in line with harmonious relationship.

Tables IV and V compare the cephalometric measurements of males and females with BP to the norms. The characteristic features of BP encountered in the whole sample were the same in both males and females, with the only notable difference in the ANB angle. The male sample revealed that there was no statistically significant difference to the norm in contrast to females which exhibited a significant decrease in the ANB angle (p=0.039)

DISCUSSION

CHARACTERISTIC FEATURES OF BIMAXILLARY PROTRUSION

The facial profiles of patients with BP appear to present with an increased convexity due to the more anterior placement of the skeletal, dental and soft tissue structures which

Table II: Cephalometric Normative values (Grimbeek, Cumber and Seedat, 1987[12]; Dawjee, 2010[13]; Wanjau, Khan and Sethusa, 2019)[14]

PARAMETER	CAUCASIAN		SA BLACKS	
	MALE	FEMALE	MALE	FEMALE
DENTAL				
		Linear		
UI-NA	4mm	4mm	7mm	7mm
LI-NB	4mm	4mm	10mm	10mm
LI- APg	0.5-1mm	0.5-1mm	7-8mm	7-8mm
		Angular		
UI-NA	22°	22°	22°	22°
LI-NB	25°	25°	38°	38°
UI-LI	131°	131°	116°	116°
LI-MP	90°	90°	102°	102°
LI-MP	90°	90°	102°	102°
SKELETAL				
		Linear		
CO-A	99.8mm	99.8mm	91mm	91mm
CO-GN	132.3mm	132.3mm	117mm	117mm
WITS	0(±1)mm	0(±1)mm	-1-2mm	-1-2mm
Convexity	2±2mm	2±2mm	4mm	4mm
UFH	50	50	50	50
LFH	70	70	70	70
		Angular		
SNA	82(±2)°	82(±2)°	87°	87°
SNB	80°	80°	82°	82°
ANB	2(±2)°	2(±2)°	5°	5°
Y-Axis	59°±6°	59°±6°	66°-68°	66°-68°
SN-Mand	32°	32°	32°-34°	32°-34°

Table III: Comparisons of cephalometric measurements in a South African sample with BP to norm values

Variable	Norm	n	Mean (±SD)	95% CI for true mean	p value#
Dental					
UI-NA (mm)	7	67	10.3 (±3.19)	9.5 – 11.1	<0.001*
LI-NB (mm)	10	67	10.5 (±2.70)	9.9 – 11.2	0.119
LI-Apg (mm)	7-8	67	8.1 (±2.65)	7.4 – 8.7	0.782
UI-NA (°)	22	67	30.8 (±8.12)	28.8 – 32.8	<0.001*
LI-NB(°)	38	67	37.7 (±7.17)	35.9 – 39.4	0.700
UI-LI (°)	116	67	107.7(±11.98)	104.8 – 110.6	<0.001*
LI-MP (°)	102	67	99.0 (±13.75)	95.7 – 102.4	0.083
Skeletal					
CO-A (mm)	91	67	83.4 (±5.21)	82.1 – 84.7	<0.001*
CO-GN (mm)	117	67	107.3 (±5.92)	105.8 – 108.7	<0.001*
Sagittal relation					
WITS (mm)	-3 to-1	67	-2.9 (±3.91)	-3.8 to -1.9	0.828
SNA (°)	87	67	82.7 (±4.90)	81.5 – 83.9	<0.001*
SNB (°)	82	67	78.3 (±3.86)	77.3 – 79.2	<0.001*
ANB (°)	5	67	4.2 (±2.87)	3.5 – 4.9	0.030*
Convexity (mm)	4	67	4.3 (±2.46)	3.7 – 4.9	0.324
Vertical relation					
Y-Axis (°)	66	67	70.9 (±4.43)	69.9 – 72.0	<0.001*
SN-Mand (°)	32-34	67	35.0 (±5.61)	33.6 – 36.3	0.168
UFH (mm)	50	67	46.3 (±3.61)	45.4 – 47.2	<0.001*
LFH (mm)	70	67	66.1 (±5.15)	64.8 – 67.3	<0.001*

*p values calculated by the t test

Interpretation

1. The mean values in the green coloured blocks are all significantly greater than the norm values (all p values are <0.001). The norm values are also all smaller than the lower limits of the 95% confidence intervals.
2. The mean values in the orange coloured blocks are significantly smaller than the norm values (all p values are <0.001 and =0.030 in one case). The norm values are also all greater than the upper limits of the 95% confidence intervals.
3. The mean values in the blue coloured blocks do not differ significantly from the norm values (all p values are >0.05). The norm values also overlap with the 95% confidence intervals.

make up the midface[5]. There have been only a few older studies investigating the skeletal and dental cephalometric features of individuals with well-balanced faces revealing the characteristics of normal occlusion among the South African black population.[12,14,15,16,17] This study can be considered one of a few studies on BP in a South African sample revealing the unique skeletal and skeletal features.

Dental features

Flaring of the upper and lower incisors is as a common finding amongst black population groups[6,16,18,19] and was similarly noted in this study, particularly more in relation to the maxillary teeth. The maxillary incisors were significantly more proclined and protrusive when compared to the norms established for this population group. The lower incisors aligned themselves more closely to the accepted angular and positional relationships with no real proclination or protrusion present. Findings which are all in conflict to conclusions drawn from studies performed on the Zimbabwean population[2] which reported maxillary incisors that were retroclined and mandibular incisors that were severely proclined. The inter-incisal angle (UI-LI: 107.7±11.98°) was found to be more than that reported for African Americans[19] and the Sudanese[20] with less proclination experienced in the South African context. In contrast, the values reported for Caucasians[5], the Taiwanese[21] and the Thai[11] amount to the sample exhibiting a greater degree of proclination and protrusion.

Skeletal features

A diagnosis of bimaxillary skeletal protrusion is made when both the maxilla and mandible are found to be in protruded positions in relation to the cranial base.[22] The results from this study on a sample of South Africans with features of BP excluded the presence of any skeletal protrusion, as they displayed no prognathism of the both the maxilla and mandible. Remarkably the maxilla was found to be retrognathic (SNA: 82.7±4.90°) as was the mandible (SNB: 78.3±3.86°), albeit to a slightly lesser degree.

In terms of the ANB angle, Jacobson in 1975 determined that the ANB angle may be affected by the anatomical position of the Nasion, rotation of the skeletal bases (jaws), lower anterior facial height or the degree of prognathism

Table IV: Comparisons of cephalometric measurements in a South African male sample with BP to norm values

Variable	Norm	n	Mean (±SD)	95% CI for true mean	p value#
Dental					
UI-NA(mm)	7	28	9.5 (±3.36)	8.2 – 10.7	0.001*
LI-NB (mm)	10	28	10.5 (±2.58)	9.5 – 11.5	0.313
LI-Apg (mm)	7-8	28	8.0 (±2.80)	6.9 – 9.1	1.000
UI-NA (°)	22	28	29.3 (±8.43)	26.1 – 32.4	<0.001*
LI-NB (°)	38	28	37.3 (±8.38)	34.2 – 40.5	0.672
UI-LI (°)	116	28	109.1(±13.98)	103.8 – 114.4	0.015*
LI-MP (°)	102	28	96.8 (±19.57)	89.4 – 104.1	0.167
Skeletal					
CO-A (mm)	91	28	84.1 (±5.46)	82.1 – 86.2	<0.001*
CO-GN (mm)	117	28	108.2 (±6.19)	105.9 – 110.5	<0.001*
Sagittal relation					
WITS (mm)	-3 to-1	28	-3.0 (±4.69)	-4.8 to -1.3	0.968
SNA (°)	87	28	83.5 (±5.23)	81.5 – 85.4	0.001*
SNB (°)	82	28	79.1 (±3.92)	77.6 – 80.5	<0.001*
ANB (°)	5	28	4.4 (±3.30)	3.1 – 5.6	0.312
Convexity (mm)	4	28	4.4 (±2.79)	3.3 – 5.4	0.463
Vertical relation					
Y-Axis (°)	66	28	70.5 (±4.86)	68.6 – 72.3	<0.001*
SN-Mand (°)	32-34	28	34.2 (±5.48)	32.1 – 36.2	0.864
UFH (mm)	50	28	46.6 (±3.56)	45.2 – 47.9	<0.001*
LFH (mm)	70	28	66.2 (±6.08)	64.0 – 68.5	0.003*

*p values calculated by the t test

Interpretation

1. The mean values in the green coloured blocks are all significantly greater than the norm values (all p values are =0.001 or <0.001). The norm values are also all smaller than the lower limits of the 95% confidence intervals.
2. The mean values in the orange coloured blocks are significantly smaller than the norm values (p values are 0.015, <0.001 and 0.003 or =0.001). The norm values are also all greater than the upper limits of the 95% confidence intervals.
3. The mean values in the blue coloured blocks do not differ significantly from the norm values (all p values are >0.05). The norm values also overlap with the 95% confidence intervals.

that the jaws possess. The ANB angle in this situation was slightly decreased at 4.2 ±2.87° (p = 0.03) suggesting a mild Skeletal Class III pattern given the applicable norm (5°). This finding may be attributed to a mismatch of the relationship between the SNA and SNB which are reduced, but with a SNB angle which is reduced to a lesser degree. The Zimbabwean[2] and Caucasian[5] populations featured a Class II skeletal pattern which presented with an increase in the ANB angle attributed to a downward and backward rotation of the mandible, except in the Zimbabwean study[2] which implicated a mismatch in a small SNB angle, to a larger SNA angle. A notable feature among Asian population groups is the presence of a decreased ANB, translating to Class III skeletal pattern[11,21] as is observed in this sample group. The presence of a mild Skeletal Class III pattern makes these patients ideal candidates for consideration of camouflage treatment.[23]

The presence of growth in a slightly more vertical direction is indicated by an increased value of the Downs Analysis (Y-Axis: 70.9±4.43°) and suggests that individuals with BP tend to be hyperdivergent. These findings are in agreement with those studies performed on Afro-Caribbeans,[24] Sudanese[20] and Caucasian populations5. However, these findings were inconsistent with the horizontally directed growth pattern found in Zimbabweans,[2] Arabs[25] and Asians.[11] The UFH (46.3±3.61mm) and LFH (66.1±5.15mm) although slightly reduced, remains in a ratio which is in line with harmonious relationship. The presence of only a slightly vertical growth pattern in addition may have significant positive effects. Orthodontic treatment with fixed appliances usually tends to have extrusive effects[23] and can assist with the correction of the mild Class III skeletal pattern as the mandible rotates downwards and backwards during treatment.

In summary an increased facial convexity in South African black patients was a result of bimaxillary dentoalveolar protrusion. There was no element of skeletal prognathism from either the maxilla or mandible. These patients also exhibited a slightly increased vertical direction of growth with males and females displaying very similar cephalometric features except a decrease in the ANB angle in females indicating a tendency to a more Class III skeletal pattern.

CONCLUSION

When compared to cephalometric norms established for the South African Black population, the characteristic features that BP patients present with include:

- Proclination and protrusion of the maxillary incisors but favourably positioned and inclined mandibular incisors. This resulted in an increased interincisal angle.
- The maxilla and mandible are both retrognathic, however the maxilla to a greater degree than the mandible resulting in a mild Class III skeletal pattern.
- The presence of a slight vertically directed growth pattern with average anterior facial height ratios.
- All characteristic features of BP are the same in males and females, except that females exhibit a smaller ANB angle indicating a greater tendency for a Class III skeletal pattern.

These findings conclude that characteristic features of the South African Black population presenting with BP are unique and highlights the importance of knowing and understanding these unique features when diagnosing and planning treatment for this population group.

Table V: Comparisons of cephalometric measurements in a South African female sample with BP to norm values

Variable	Norm	n	Mean (±SD)	95% CI for true mean	p value#
Dental					
UI-NA (mm)	7	39	10.9 (±2.96)	10.0 – 11.8	<0.001*
LI-NB (mm)	10	39	10.5 (±2.83)	9.6 – 11.4	0.242
LI-Apg (mm)	7-8	39	8.2 (±2.57)	7.3 – 9.0	0.710
UI-NA (°)	22	39	31.9 (±7.82)	29.4 – 34.4	<0.001*
LI-NB (°)	38	39	38.0 (±6.26)	35.9 – 40.0	0.919
UI-LI (°)	116	39	106.6(±10.38)	103.3 – 110.0	<0.001*
LI-MP (°)	102	39	100.7 (±7.05)	98.4 – 102.9	0.254
Skeletal					
CO-A (mm)	91	39	82.9 (±5.04)	81.3 – 84.5	<0.001*
CO-GN (mm)	117	39	106.6 (±5.71)	104.8 – 108.4	<0.001*
Sagittal relation					
WITS (mm)	-3 to-1	39	-2.8 (±3.29)	-3.8 to -1.7	0.700
SNA (°)	87	39	82.1 (±4.63)	80.6 – 83.6	<0.001*
SNB (°)	82	39	77.7 (±3.77)	76.5 – 78.9	<0.001*
ANB (°)	5	39	4.1 (±2.55)	3.3 – 4.9	0.039*
Convexity (mm)	4	39	4.2 (±2.23)	3.5 – 4.9	0.522
Vertical relation					
Y-Axis (°)	66	39	71.3 (±4.12)	70.0 – 72.6	<0.001*
SN-Mand (°)	32-34	39	35.5 (±5.70)	33.7 – 37.3	0.106
UFH (mm)	50	39	46.1 (±3.67)	45.0 – 47.3	<0.001*
LFH (mm)	50	39	66.0 (±4.44)	64.6 – 67.4	<0.001*

*p values calculated by the t test

Interpretation

1. The mean values in the green coloured blocks are all significantly greater than the norm values (all p values are <0.001). The norm values are also all smaller than the lower limits of the 95% confidence intervals.
2. The mean values in the orange coloured blocks are significantly smaller than the norm values (p values are <0.001 and 0.003 and = 0.039 in one case). The norm values are also all greater than the upper limits of the 95% confidence intervals.
3. The mean values in the blue coloured blocks do not differ significantly from the norm values (p values are >0.05 and = 0.106). The norm values also overlap with the 95% confidence intervals.

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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.

Prevalence of oral impacts on daily performances among adolescents living with HIV at a tertiary paediatric hospital in Johannesburg, South Africa

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ABSTRACT

Objectives

To determine the prevalence of oral impacts on daily performance among HIV positive adolescents attending a wellness program at a Tertiary Hospital Johannesburg.

Methods

A cross-sectional study design was conducted where a clinical examination was performed to determine the intra-oral mucosal lesions, decayed, missing, filled teeth (DMFT) and Significant Caries Index (SiC). The Child-Oral-Impact on Daily-Performance (Child-OIDP) questionnaire was interviewer-administered to the adolescents at the tertiary paediatric hospital.

Results

There were n=208 adolescents with mean age 15.3 years (SD: 2.19; range 9.6-19.9 years). Fifty-five percent of the adolescents were female and 32% of had unemployed parents. About 39% rated their oral health as poor. More than 70% reported not accessing dental services six months prior. The most reported oral conditions were toothache (28.4%), unwanted colour of teeth (24.5%) and bleeding gums (24.0%). The dental caries prevalence was 87%, the DMFT was 3.9 (SD: 3.2; range 0-16) and the SiC was 7.6 (range 4-16). The participants had very minimal restorations (11.7%). The most common mucosal condition identified was linear gingival erythema (27.4%). The prevalence of at least one oral impact was 82% whilst the three mostly impacted activities were difficulty cleaning teeth (53.4%) eating food (51.2%) and enjoying being with people (48.9%). The distribution of the overall impact scores was skewed .The scores ranged from 0-56 with a median of 6 and a mean score of 9.3 (SD = 10.5). The individual mean score range was, 0 to 9, the highest being 'smiling or laughing' at 2.8. A poor self-rated oral (p = 0.00) and not being satisfied with appearance of teeth and mouth (p = 0.05) was related to the overall impact score.

Conclusion

There was a high prevalence of oral impacts, dental caries and the symptoms related to dental caries. The most impacted activity was cleaning teeth and eating. These activities are related to the symptoms reported. It is imperative that dental caries and the symptoms are managed well to reduce the impacts on the adolescents' daily oral activities.

Key words

Adolescents living with HIV (ALHIV), oral health-related quality of-life (OHRQoL), Child-Oral-Impact on Daily-Performance (COIDP)

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Introduction and background

The FDI World Dental Federation vision 2020 explains that the definition of oral health is multi-faceted and includes the ability to speak, smile, smell, taste, touch, chew, swallow and convey a range of emotions through facial expressions with confidence and without pain, discomfort and disease of the craniofacial complex.[1] The ability to have complete oral health functions is even more essential for people living with chronic conditions and infected by the Human Immunodeficiency Virus (HIV). General health is interrelated to oral health especially the self-rated oral health[2] and the goal is to realise that health for all is achieved by all members of the population.

The concept of oral-health related quality of life (OHRQoL) is explained simply and loosely as the 'impact of oral conditions on daily functioning and wellbeing'.[3] The concept of OHRQoL is context reliant as culture and society shapes an individual's belief system and influences how health and illness is viewed.[4]

The relationship between HIV and oral health status has been investigated, showing that poor health practices such as medicine non-adherence can lead to manifestations of oral lesions and conversely certain HIV regimens may cause uncomfortable oral side-effects like xerostomia (dry mouth).[5] The current information on HIV in South Africa reports that 310 000 [200 000 - 540 000] children aged 0 to 14 are living with HIV while 12 000 [6900 - 31 000] were newly

infected.[6] Approximately 370 000 adolescents aged 10-19 years were amongst the HIV infected population in South Africa.[6] Among the adolescents, statistics show that those who are 15-19 years are 5.8% female and 4.7% male.[6] Amongst those living with HIV according to the UNAIDS epidemiological estimates in 2019, adolescent girls are more likely to be infected with HIV than adolescent boys in sub-Saharan Africa.[6]

The adolescents living with HIV (ALHIV), have generic lifestyle and congenital oral health challenges. They have a risk of developing oral conditions such as dental caries, periodontal disease, halitosis, xerostomia and some of these conditions are directly related to compliance and adherence to highly active anti-retroviral treatment (HAART). These oral pathologies or abnormalities can affect one's health-related quality of life (HRQoL) i.e. self-perceived mental, physical, and social perspective health status,[7] enjoying food; speaking and pronouncing clearly; cleaning teeth; sleeping and relaxing; smiling; laughing and showing teeth without embarrassment; maintaining usual emotional state without being irritable; carrying out major work or social roles; and enjoying contact with people."[8] Accordingly, the measure of oral health status has shifted from being pathology-focused to being more holistic and patient-centred i.e. the patient's overall oral *health* is taken into regard.

Research in socio-dental indictors has been burgeoning and several Oral Health-Related Quality of Life (OHRQoL) tools have been developed. One such tool, is the *Children Oral Impact on Daily Performance*, which assesses the impact of ill-oral health on performing daily functions. The instrument was modified and amended for dentistry from the World Health Organization's (WHO) International Classification of Impairments, Disabilities and Handicaps.[9] This measurement tool is unique in that it bridges the gap between objective (normative) and subjective measures of oral health.[3]

There is a strong association between dental visits, oral health status and OHRQoL.[10] Routine dental visits have a protective effect on OHRQoL[11] and those who those who delay seeking oral healthcare often present with emergency dental needs and report a poor OHRQoL.[12] While OIDP studies have been widely conducted for adults and children (Child OIDP), adolescent focused OIDP studies, specifically for adolescents living with HIV (ALHIV), remain scant.[13] Although measurable strides have been made in the effort to prevent and manage HIV/AIDS, there is a shift in infection trends toward the adolescent group (10 – 19 years) whose estimated global prevalence is 1.1 and 2.4 million.[11]

The South African disease trajectory shows similar trends with an increase in the prevalence from 3.0% in 2008, to 3.2 in 2012 and 4.1% in 2017.[14] Relatedly, a systematic review of caries and periodontitis disease patterns revealed that although there is a noticeable decrease in dentine cavitated carious lesions, the prevalence is still high among middle and low-income countries[15] and adolescents are particularly at risk. This group generally has a low risk assessment of disease i.e. their perceived threat of disease is skewed toward aesthetics rather than tooth decay and its associated consequences – pain, invasive treatment and possible tooth loss.[12] As a result, this group may delay healthcare seeking, particularly in households where oral health is not prioritised. An understanding of adolescent behaviour, oral health status and OIDP can facilitate dental services planning that is aligned to patient and community needs. The study will generate important findings on the the adolescent's oral health related quality of life and provide empirical evidence needed to initiate support and enforce holistic integration of oral disease prevention and oral health promotion interventions and general national adolescent and youth policy.

This study is part of a series of OHRQoL studies conducted on the site using different OHRQoL indices. It is the first study to use the Child Oral Impact on Daily Performance tool among the ALHIV in South Africa.

MATERIALS AND METHODS

The site

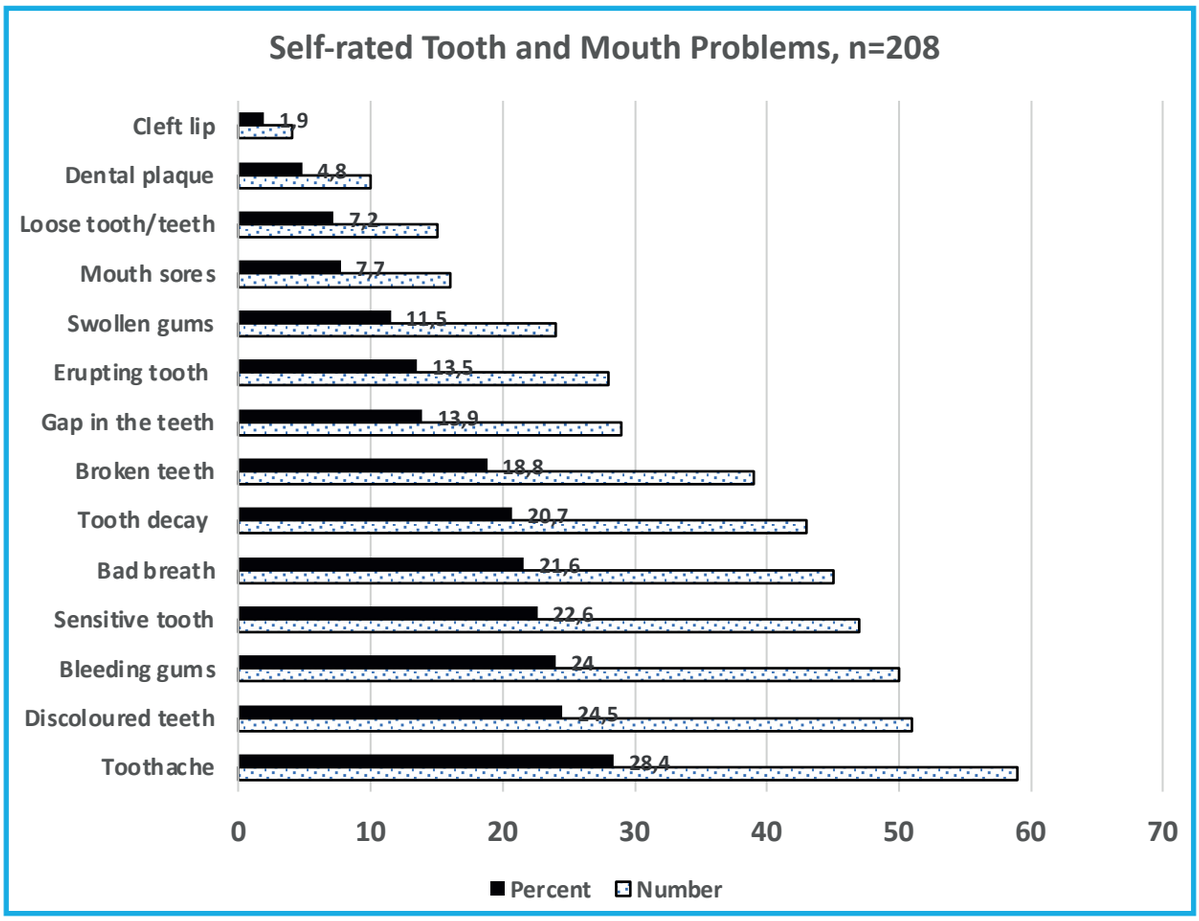
The Greater Johannesburg Metropolitan Area and the areas in the periphery, get health services from the Charlotte Maxeke Academic Hospital. Within the hospital, is the HIV Wellness site at the Paediatric Virology Clinic. The Department of Community Dentistry at the Wits Oral Health Centre provides dental services in collaboration with the clinic within the Hospital. This gave rise to the Oral Health Paediatric Virology Project (OHPVP) where daily; during

Table 1: Socio-demographics and other characteristics of the study population

Characteristic		N[a] (%)	Mean ±SD
Sex			
	Male	94(45.2)	
	Female	114 (54.8)	
Age, years			15.3±2.19
Parent Employment status			
	Unemployed	60(31.8)	
	Employed	129(68.3)	
School Level			
	Primary School	55(30.9)	
	High School	123(69.1)	
Age category			
	10-14 years	77(37.0)	
	15-20 years	131(63.0)	

[a] The total is not 208 due to missing values

FIGURE 1: The tooth and mouth problems self-reported by the adolescents



the week children are examined and provided with dental treatment within the paediatric clinic according to need.

Participant enrollment and data collection

The adolescents living with HIV (ALHIV) were enrolled from the HIV Wellness site during the clinic visits in 2016. The recruitment process was completed over a period of six months (February to August 2016) to enroll the participants into the study. During the recruitment process, the adolescents' parents and the adolescents were informed about the study by the administration staff at the center. Their permission was sought and those with parental consent and own assent became part of the study. The sample size was based on the HIV Wellness clinic attendance of approximately 400 patients in six months. Assuming an error of 5% and a 95% confidence interval, an estimated number of 196 participants was the calculated sample, to allow for non-respondents, 208 participants were enrolled. The participants enrolled as they came for their daily wellness visits.

Clinical oral examination

Detailed clinical oral assessment was conducted to detect dental decay and the oral mucosal lesions associated with HIV infection. The decayed missing and filled teeth (DMFT) index as outlined in the basic survey methods by World Health Organization (WHO, 1997) was applied to diagnose dental decay and later the Significance caries index (SiC) was calculated. Patients were examined sitting in the supine position on the portable dental chair using artificial light. The intra-examiner reliability was done by re-examining one tenth of the sample the examiner and the calculated kappa statistics was 0.83. Simultaneously, the Oral HIV/AIDS Research Alliance (OHARA) case definitions by Shiboscki et al 2009; were used to record the oral mucosal conditions. The intra-oral examination was performed by a calibrated clinician (YMK). The clinician received training using the training material slides by Shiboscki et al 2009; the score for correctly diagnosed conditions had to be 80% and above in other to proceed with data collection; the intra-examiner score was 0.87.

Ethical Clearance was obtained from the Human Research Ethics Committee of the University of the Witwatersrand M141150. Written permission for the site was obtained from the managers, written signed consent and assent was obtained from the participants.

Child-OIDP tool administration.

Following a clinical examination, the Child-Oral-Impact on Daily-Performance (COIDP)[16] questionnaire was interviewer-administered to the adolescents at the wellness site. Socio-demographic information collected included gender, school information such as grade in school, the parent employment status, dental treatment need, satisfaction with teeth or mouth, oral hygiene practice, access to oral health education and source/s thereof.

The COIDP tool[16] sought information based on the eight daily activities/performances namely: *eating food, speaking, cleaning teeth, relaxing or sleeping, feeling different, being able to smile and /or laugh without embarrassment, doing*

Table 2: Dental caries prevalence and the oral health behavioural traits of the participants

Characteristic		Na (%)	Mean ±SD
Dental treatment need			
	Disagree	40(19.8)	
	Unsure	60(29.7)	
	Agree	102(50.5)	
Dental attendance in 6 months prior to study			
	Yes	55(27.1)	
	No	148(72.9)	
Frequency of Tooth brushing			
	Once a month	13(6.44)	
	Once a day	110(54.5)	
	Twice a day	79(39.1)	
Ever received advice about Oral health care			
	Yes	151(72.9)	
	No	56(27.1)	
Source of oral health care advice			
	School	77(37.0)	
	Family/friends	68(32.7)	
	Dental clinic	59(28.4)	
	Television/radio	37(17.8)	
	Magazine/newspapers	17(8.2)	
Satisfaction with current oral health status			
	Not so satisfied	90(45.7)	
	Satisfied	67(34.0)	
	A lot satisfied	40 (20.3)	
Global Oral Health Rating			
	Poor	77(38.7)	
	Fair	74(37.2)	
	Good	48(24.2)	
Dental caries	D>0	133(87.5)	3.2±2.9
Missing Teeth	M>0	30(22.9)	0.5±1.1
Filled teeth	F>0	15(11.7)	0.3±1.0
Significant Caries Index	SiC		5.5±2.6

[a] The total is not 208 due to missing values

schoolwork and lastly, *enjoying being with people.* All questions were prefixed by – "in the past three months have you had the oral problems when you were…" The participants were expected to report on the frequency (once/twice a month = 1, once/twice a week = 2, three or more times a week = 3); the severity (A little = 1, moderate = 2, a lot = 3); and choose the oral condition from a list of 17 conditions (e.g. toothache, mouth ulcers etc.) and were allowed to mention any other conditions not on the list that caused the impact on daily activity.[13]

Data Analysis

Data was analysed using Stata version 14 (Stata Corp, College Station, TX, USA) and SPSS (version 23). Socio-demographics were assessed through sex, age, school grade, parent employment status and township/area of location. Additional information before answering the COIDP[16] tool were based on the following: Dental treatment need "yes/no", Satisfaction with current oral health status" 5-point Likert scale", Dental attendance in 6 months prior to study "yes/no", 5 options ranging from never, once a month, once a week, once a day to twice a day", self-rating of oral health. All demographic information was dichotomised and presented in frequencies and percentages.

The mean DMFT was calculated, dental caries prevalence (dichotomized as D=0 and D >0 and DMFT=0 and DMFT>0) were also reported. The HIV clinical markers retrieved from records were: WHO staging, duration on antiretroviral treatment and the CD4 count and viral loads (VL). The CD4 counts and VL are reported in means and median due to the skewness. Additionally, the Centre for Disease Control (CDC) guideline categories were used stratify the CD4 counts and the VL into three categories. The participants with CD4+ T cell count >500CD4 cells/mm^3 (category 1), 200-500CD4 cells/mm^3 (category 2) and <200CD4 cells mm^3 (category 3). Similarly, the VL was categorized using the CDC cut off of <40VL copies/ml (asymptomatic); 40-1000VL copies/ml (symptomatic); and >1000VL copies/ml(AIDS stage) .

Thereafter The COIDP score; the impact for every performance, was calculated by the product of frequency and severity scores of 0, 1, 2, 3 each with regards that performance. The possible range of scores was 0 to 9 for performances. The overall impacts score was then calculated by the sum of all eight performances with range of 0 to 72 divided by 72 and multiplied by 100.[14] The internal consistency reliability of the scales derived were assessed using Cronbach's Alpha test once.

RESULTS

There was a total of 208 adolescents who agreed to participate in the study. The table below (Table 1) depicts their demographic data. The mean age was 15.3 years (range = 9.6-19.9 years; SD: 2.199) and approximately 55% participants were female. Regarding their socio-demographic status, 31.8% of participants indicated that their parents were unemployed.

Almost 40% of the participants rated their oral health as poor and more than 70% reported not accessing dental services six months prior to the date of the interview.

DENTAL CARIES

The dental caries experience for the whole group expressed in mean DMFT was 3.9 (SD: 3.2) . The significant caries index (SiC) measures the DMFT in the highest third of the study population, the SiC index was 7.6 (SD: 2.72) (Table 2). The Decayed component contributed more to the DMFT score with a high value of D=3.2; SD: 2.9. The group's overall dental caries prevalence was 87% with at least one participant having three decayed teeth, about one (0.5 SD: 1.1) missing tooth and close to none had filled teeth (0.3 SD: 1). 11.7% of the participants had restorative treatment done on them. Approximately 76% of the adolescence rated themselves to have poor to fair oral health while nearly half (46%) were not satisfied with how their teeth or mouth looked. A good majority (72.9%) of them have received oral health education from sources such as school settings (37%), family or friends (32.7%) and even the dental clinic visits (28.4%).

Most adolescents displayed good HIV clinical markers where most were at WHO clinical staging of 1-2 (77%), undetectable viral loads (59%) and higher CD 4 counts (65%). They have been on anti-retroviral treatment for up to 16 years with a mean of 7.6 years as illustrated in Table 3.

Table 4 shows that the daily activity most impacted on was cleaning teeth (53.4%) followed by eating food (51.2%) and third was enjoying being with people (48.9%). The distribution of the overall impact scores was skewed with high kurtosis levels. The scores ranged from 0-56 with a median of 6 and a mean score of 9.3 (sd =10.5). The possible range of individual mean score was from 0 to 9, the mean score for 'cleaning teeth' was the third highest at 2.6, while the highest individual was that of 'smiling or laughing' at 2.8. The tool displayed good internal consistency with the Cronbach alpha of 0.68 with 24 items in the scale.

There was an association between COIDP impact scores and the oral problems reported by the adolescents using the Mann-Whitney U test. These oral conditions were

Table 3: The HIV clinical indicators for the adolescents

Characteristics	Attribute	N	%
Marginal Gingiva	Normal	114	61.96
	Mild Gingivitis	53	28.8
	Moderate Gingivitis	17	9.24
Periodontal Status	Normal	111	62.01
	LGE	49	27.37
	HIV-gingivitis	19	10.61
WHO Clinical staging	1-2 Staging	131	77.06
	3-4 Staging	39	22.94
DART# in years m(SD)	Min-max 0.2 -16.9 years	7.63	4.2
Weight (kg)	Min-max 34.9-130.45	68.5	15.23
CD4 count (n=188)	Min-max 0- 3904	643.3	402.14
	Median CD 4 counts	629	IQR: 401.5-796
	<200CD4	22	11.70
	200-500CD4	43	22.87
	>500CD4	123	65.43
Viral Load(n=193)	mean	6970.53	28193.43
	Median VL	39	IQR: 39-450
	<40	113	58.55
	40-1000	43	22.28
	>1000	37	19.17

#DART-duration on anti-retroviral treatment

Table 4: Prevalence of the daily activities impacted on by mouth/teeth problems and the Children –OIDP total and subscale scores

Child-Oral Impact on Daily Performance	Overall	Eating food	Speaking	Cleaning teeth	Sleeping/ relax	Feeling different	Smiling/ Laugh	School work	Enjoy being with people
COIDP Prevalence n (%)		105(51.2)	59(28.9)	111(53.4)	60(29.1)	72(34.6	82(40.2)	73(35.6)	99(48.29)
Impact intensity (%children with impacts)									
Never		50.1	75	51.4	68.3	68.8	65.9	69.7	58.7
Little		26.6	15.9	21.2	14.9	15.4	12.5	13.5	19.2
Moderate		11.1	3.9	16.4	7.7	10.6	9.6	6.3	8.7
Severe		14.4	5.3	11.1	9.1	5.3	12.0	10.6	13.5
Impact Score									
Range	0-56	0-9	0-9	0-9	0-9	0-9	0-9	0-9	0-9
Mean(sd)	9.3(10.5)	1.7(2.5)	0.8(1.9)	1.9(2.6)	0.34(1.4)	0.0(1.3)	1.6(2.8)	1.2(2.4)	1.6(2.6)
Percentiles (25,50,75)	1,6,13.5	0,0,2	0,0,0.5	0,0,3	0,0,0	0,0,0	0,0,2	0,0,1	0,0,2
Kurtosis	6	5	12	4	27	21	4	7	5

toothache, bleeding gums swollen gums and mouth sores (p-value<0.005). Similarly, a poor self-rated-oral-health (p-value<0.05) and not being satisfied with appearance of teeth and mouth (p-value=0.05) was related to the child-oral-impact on daily performance score.

DISCUSSION

Demographic characteristics of the participants

The demographic characteristic of the participants show that 55% participants were females and similar results were observed in other studies in Africa and Asia.[15,16] The South African parents seemed to be more educated as 30% had attained primary and 69% had secondary education in contrast to 15% and 22% respectively for the community in Tanzania. [15]

Studies have suggested that oral health outcomes are influenced by the parent's education level.[17] The effect of socioeconomic conditions on oral health related quality of life has also been reported. Low educational level may lead to reduced income, unemployment and poor occupational status; these conditions influence health behaviours and self-rated oral health.[18] The finding of this study reveal that most parents are employed at 68,3 % and similar results were observed from a population in Brazil.[18]

Table 5: Association of COIDP impact score and the mouth problems of he adolescents (p-values)

Attributes	P-value
Toothache	0.002*
Bleeding gums	0.01*
Sensitive teeth	0.49
Swollen gums	0.003*
Tooth decay	0.19
Loose tooth	0.58
Mouth sore	0.02*
Bad breath	0.12
Discoloured teeth	0.13
Dental Visit	0.8
Poor oral health self-rating	0.00*
Not satisfied with OH	0.05*
Older Adolescent	0.9

*P≤0.05

It has been noted in the South African context that oral health is impacted when parents or guardians are employed as they are not home to monitor the oral health self-care to the children.[19] This could explain the findings observed in this study as 68% of parents were working and the participants presented with conditions including dental caries and periodontal disease. The distance from the workplace to home and long working hours could contribute to the oral health of the participants.[19,20]

The results of this current study concur with other studies that indicated that the impact of education of parents and guardians on the outlook of learners cannot be ignored as the socioeconomic status plays an important role in the utilization of health services.[21,22] In some studies the maternal education was associated with the use of dental services, indicating that lower oral health knowledge leads to unhealthy behaviors and less interest in preventive treatment.[23] The role of education in health could lead to more health-conscious and healthier lifestyle choices.[24]

The participants reported the need for dental treatment, had dental caries and experienced toothache. This is not surprising as statistics from the Global Burden of Disease Study in 2019 estimated that oral diseases affect close to 3.5 billion people worldwide, 2 billion with caries of permanent teeth being the most common condition; and 520 million children suffer from caries of primary teeth.[25]

Of concern was that 72% of the participants had not sought dental treatment in six months prior to the study. This is critical as lack of dental care has an impact on periodontal and dental health. Oral health conditions could be prevented, and the importance of regular checkups is crucial in ensuring that patients maintain meticulous oral hygiene. Over 31% of the adolescents' parents were unemployed. Adolescents whose parents are of a low socio-economic status are less like to practice good oral health behaviour such as frequent dental visits[27] as observed in the study. While some studies have pointed to adolescent self-esteem being a predictor of dental visits, the explanations sought to determine this relationship are rare and inconsistent. [28]

From a life course perspective, it can be hypothesized that children from families with early life low socio-economic conditions may have less access to (and use of) dental services ;variety of oral hygiene items and may be more likely to develop harmful oral health behaviours later in life.[26,27] These could predispose individuals to problems such as dental caries, gingival bleeding, dental pain, malocclusion as observed from the participants in the study which in turn may impact on adolescents' oral health related quality of life.[26,27]

The participants indicated that the source of oral health care advice was obtained from school. This is important as it shows the value of the integrated school health programme in the Gauteng district oral health setting where learners get the opportunity to be educated on oral health. The influence of family and friends is important in relaying health messages as 32% of participants relied on them to share information on oral health. The oral health/dental clinic setting still has a role as most learners found it a suitable space to gain oral health education (28%). Within this perspective and considering the challenges of the adolescent phase in life, it is necessary to develop educational measures on oral health in schools by means of programs capable of meeting the needs and characteristics of this portion of population. [28]

Dental Caries

The dental caries prevalence for this cohort was high at 87% and the decayed portion contributed most to the dental caries experience. These dental caries prevalence rates are higher than the findings observed from the South African National Children Oral Health Survey which showed that 36.1% 12 years old children had dental caries albeit, the survey was conducted more than two decade later.[29] Similar studies in Sudan Nigeria, Uganda and Tanzania on OHRQoL using the COIDP measure among child participants, showed different caries prevalence results. The prevalence was 45.8% in Sudan[30], 21.9 % in Nigeria[31], 48% in Uganda [36] and 43.5% in Tanzania.[32] The findings from the Ugandan study indicates that all the participants were HIV infected like the current study. The current cohort had a higher prevalence, and this was corroborated by the high levels of self-reported tooth decay and toothache. The higher prevalence of dental caries can even explain why the participants rated themselves poorly with regards their general oral health and were not satisfied with how their teeth or mouth looked. The results from this study indicated that the dental problems, mostly dental caries and self-reported toothache and decay impacted on the daily activities of the adolescents. The results are similar to the Tanzanian where the overall prevalence had a greater impact on scores and children OHRQoL.[32] In addition, a similar Thailand study revealed that among all kinds of oral diseases, dental caries related most to oral impacts on children's and adolescents' QoL.[33] These findings were also comparable to previous studies showing that sensitive tooth and toothache impacts on most of the eight daily performances.[13] Participants in the study struggled with eating food and this may have created problems on the nutritional balance and status of the participants. It is concerning that the treatment such as dental restorations were done very minimally however, the participants did receive oral education and thus have an idea of prevention.

Oral health related quality of life scores and impacts on daily activities.

All participants in the study reported at least one impact on daily performance. In addition, cleaning teeth and eating were the highest reported impacts on daily performance, with a COIDP prevalence of 53.4% and 50.5% respectively. This is slightly different to the Thailand study where impact on cleaning teeth was 48.5% but they experience a higher impact on eating at 72.9%.[13] Tanzania also reported eating as the highest impact on daily performance, although the prevalence was comparably low at 22.8%.[32]

The mean COIDP of our study was high (9.3 SD: 10.5), indicating self-perceived poor OHRQoL. Our results are in stark contrast with socioeconomic counterparts in other upper-middle income countries. For instance, Brazil, Thailand, and Peru reported mean COIDP scores of 7.1, 8.8 and 7.8 respectively.[13,34] The mean score also did not compare to high- and low-income country like France –7.8[35] and Tanzania - 1.2.[32]

There are several factors that may explain the reported poor OHRQoL. The study's cohort is specificically– adolescents living with HIV. While OHRQoL studies are scant for this group, a study of HIV positive Ugandan mothers using the OIDP tool, found HIV status was not significantly associated with oral impacts on daily performances.[36] On the other hand, socio-economic status may have contributed to the reporting of poor OHRQoL. Over 60% of the participants parents were unemployed; some OHRQoL studies have demonstrated that children who come from low-income households and large families report significantly high COIDP scores, compared to their counterparts with higher socio-economic characteristics.[35]

Enjoy being with people as well as smiling/laughing were the third and fourth highest reported impacts on daily performance. A study in 2015 which assessed adolescents' perceptions on oral health and health care seeking behaviour, found that aesthetics was the most cited reason for seeking healthcare services.[12] Adolescents valorise appearance, therefore it may contribute to the perceived poor OHRQoL [34]. The caries prevalence in our study was high and toothache was the most reported mouth-related problem. A COIDP study in Saudi Arabia found that toothache was reported as a perceived impairment for almost all oral impacts and was the strongest predictor of COIDP. [37] Considering that eating and cleaning teeth were the highest impacts on daily performance in our study, dental problems (toothache) and impact on daily performance.

Majority of participants reported low oral health care seeking in the past 6 months, which would explain perceived poor oral health behaviour. A study in Uganda found that those adolescents who frequented dental facilities were more likely to report poor OHRQoL.[38] Attendance patterns were related to the perceived treatment need among Ugandan school children and were considered as a proxy for oral health related quality of life.

Limitations

The adolescent self-rated tooth decay and toothache may be over-rated, self-reporting also poses the risk of bias. This is specifically true for young people who may be inclined to give socially desirable responses. However, the normative assessment of dental caries provided an objective assessment of dental caries.

Conclusion

The adolescent living with HIV infection in the study

setting had high prevalence of dental caries. However, they displayed good HIV clinical markers. Approximately each adolescent had at least three teeth with dental caries and few restorations done. They generally rated that their health was not good and had a poorer oral health related quality of life as they experienced toothache, bleeding gums and discolored teeth. Oral symptoms, infrequent dental access and aesthetic were associated with a poorer oral health related quality of life.

The findings from the study highlight the infrequent attention given to the impact that oral health has on quality of life. It is therefore recommended that an inclusive approach is required, where not only clinical conditions are valued, but the patient-based input are also considered. This holistic approach will enhance the focus for oral health services to be linked with general health so that the social and psychological impact are considered when planning for wellness centers. Future research is also recommended in this field to use longitudinal studies to see the changing patterns of disease impacts on the quality of life.

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Drug-induced gingival enlargement – Oral implications for prescribing physicians

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ABSTRACT

A male patient presented with a main complaint of persistent growth of the upper and lower gingiva that bled easily and resulted in an inability of maintaining proper oral hygiene. He reports that the growth of the gingiva started approximately three years prior to consultation in our clinic and is asymptomatic. His medical history revealed that he suffers from epilepsy and was being treated with a daily anticonvulsant, namely Phenytoin (100mg).

Full-mouth non-surgical periodontal therapy was performed and supplemented with an adjunctive chlorhexidine mouth rinse as a chemical plaque control mechanism. Part of the systemic phase of management of the patient, involved requesting the medical physician change the current epilepsy medication to Epilim®, which was beneficial in contributing to the resolution of gingival enlargement. Significant reduction in gingival inflammation and enlargement were achieved with the non-surgical treatment. Corrective surgery therapy was performed to treat those areas of DIGE that had not resolved.

Acronyms

DIGE - Drug-induced gingival enlargement
GH – Gingival hyperplasia

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Key Words

gingival enlargement, drug-induced gingival enlargement, gingivitis

BACKGROUND

The Department of Oral Medicine and Periodontics (Faculty of Dentistry, University of the Western Cape) has in the recent years experienced an increase in the number of patients presenting with gross enlargement of the gingiva due to the prescription of medications for a variety of systemic conditions. A significant increase in the number of gingival enlargement cases has been observed in patients taking Phenytoin® presenting to the Faculty of Dentistry (UWC) for management. There could be a variety of reasons for this increase, which one include an increased awareness of oral lesions by the patients or that medical personnel have adopted a protocol of considering oral health management as a part of holistic patient care. It is thus imperative that prescribing practitioners are aware of the potential adverse effects of certain medications on the gingiva and overall oral health of the patient.

CASE PRESENTATION AND MANAGEMENT

A 32-year-old male presented at the Oral Medicine Clinic at the University of the Western Cape Dental Faculty (UWC), Tygerberg campus. His main complaint was an approximate three-year history of painless, persistent growth of the upper and lower gingiva in both jaws, that bled easily and resulted in him not being able to brush his teeth adequately.

His medical history evaluation revealed that he suffers from epilepsy, and he was being treated with anticonvulsant (Phenytoin 100mg daily).

Extra-oral examination of the head and neck region revealed bilateral palpable submandibular lymphadenopathy. The intra-oral examination demonstrated diffuse, gross enlargement of the gingiva on both the mandible and the maxilla. The gingiva was inflamed and demonstrated a tendency for spontaneous bleeding. Gross plaque and calculus deposits presented on all teeth throughout the oral cavity. (Figure 1 & 2)

MANAGEMENT

The gross enlargement of the gingival tissues promotes poor

Figure 1: Shows labial and buccal aspect with gross hyperplastic gingival tissue and plaque deposits associated with poor oral hygiene maintenance.

Figure 2: Shows the hyperplastic gingival tissue involving the palatal and lingual aspects of the maxilla and mandible.

oral hygiene as the patient is unable to adequately brush the teeth. Therefore, the biofilm remains undisturbed, and inflammation persists leading to more hyperplastic response of the gingiva and even the progression of periodontal disease. Removing plaque disturbs the biofilm and resolves inflammation.

The management of this patients was structured into the following phases:

Systemic Phase

Consultation with the physician was arranged and it was decided to discontinue phenytoin and replace it with Epilem™ which resulted in similar management of epilepsy but with more manageable oral adverse side effects.

Initial Phase

A comprehensive oral hygiene education was provided to institute adequate homecare maintenance by the patient. Full mouth non-surgical periodontal therapy was performed, and the patient was provided a 0,2% chlorhexidine based mouth rinse as an adjunctive chemical plaque control measure.

Due to the amount of gross calculus and plaque deposits on the teeth, a two-week follow-up interval was performed to enforce the oral hygiene and evaluate progress of the initial phase of treatment (Figure 3 & 4). The professional removal of plaque reduces the level of inflammation and allows for a resolution of the gingival enlargement to a certain degree. The benefit of reducing gingival inflammation is it assists in reduction of the gingival enlargement, and it reduces the level of bleeding tendencies during surgical interventions if treatment proceeds into the surgical corrective phase.

Significant reduction in the degree of gingival hyperplasia was present. However, it was decided that the patient would benefit from another session of non-surgical periodontal therapy to further reduce the levels of plaque accumulation and ultimately reduce the extent of the gingival inflammation still present.

At this stage another 2 week follow-up consultation was made to monitor the progress and further enforce the oral hygiene practices of the patient. (Figure 5 & 6)

Corrective Phase

Once there was resolution of the gingival inflammation and significant reduction in the gingival enlargement, it was decided to proceed with a gingivectomy to correct the contours of the gingiva on areas that showed incomplete resolution was performed. (Figure 7)

The sites considered included the anterior labial aspect of the mandible and the buccal aspect of the first quadrant. (Figure 7) Surgery was done using the gingivectomy knives by placing a partial thickness incision on the keratinised mucosa affected. The incision run from the distal central incisor of the first quadrant to the mesial second molar in the maxilla and between the mesial aspects of the first premolars in the mandible. A second salcular incision is made parallel to the initial incision then joined. The affected tissue is than removed following partial thickness flap elevation leaving behind exposed connective tissue. No dressing is placed, and the site is set to heal by secondary intention.
The post-operative medication involves the use of 0.2% chlorhexidine mouth wash and analgesics including paracetamol and non-steroid anti-inflammatory drugs to minimise swelling and discomfort.

The two weeks follow up following the gingivectomy procedure showed good post-operative results with healed gingiva and a greatly improved oral hygiene status. (Figure 8)

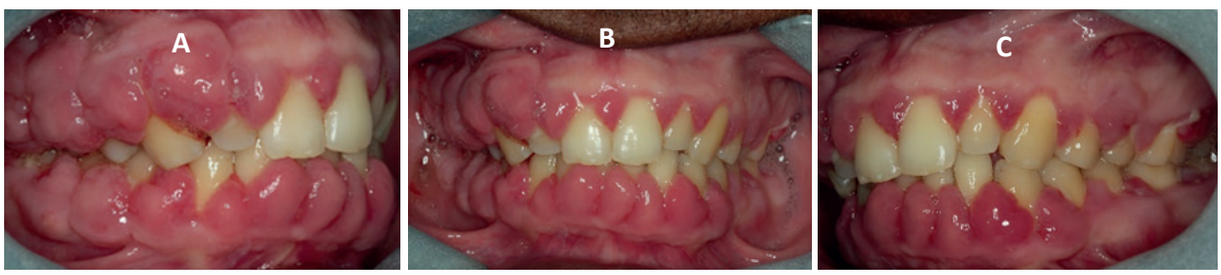

Figure 3: Shows hyperplastic tissue on the buccal and labial aspect 2 weeks after initial phase treatment. Notice the reduction in the extent of the erythema of the gingiva (3.B).

Figure 4: Shows hyperplastic tissue on the palatal and lingual aspect 2 weeks after initial phase treatment.

Figure 5: Shows extensive improvement in the appearance of the gingival tissues. Some hyperplastic gingival tissue still noted on the anterior labial aspect and the first quadrant. Note the improvement of the oral hygiene and absence of erythema.

Maintenance Phase

Following a complete resolution of the gingival enlargement, the patient was given a three months follow-up consultation for maintenance and thereafter, routine six monthly dental consultations. During the 6 monthly visits non-surgical periodontal therapy is performed together with continued enforcement of adequate oral hygiene education.

DISCUSSION

There are many factors attributing to the development of gingival enlargement, which can present either as localised or generalised. Alteration of the gingival tissues dimensions is considered a consequence of a pathologic event. However, most enlargements of the gingiva can be reversible, while some cases following a chronic pathway may advocate surgical interventions.[1]

Pathology of the gingiva, as in all other pathologic processes, may results in three clinical outcomes following inflammation of the periodontium. The clinical gingival lesions may either (1) undergo complete resolution of the inflammation and the tissues regain a state of health (i.e., homeostasis), (2) progress to destruction of the periodontal tissues leading to evident loss of clinical attachment and ultimately loss of dentition (i.e., periodontitis), (3) or the body responds by tissue fibrosis.[1]

Tissue fibrosis develops as a defence mechanism attempting to prevent progression of inflammation. Within the gingival connective tissue fibroblasts lay down an increased amount of collagen and non-collagenous proteins. This increased deposition of the matrix is not adequately balanced by degradation of the matrix composition by the lytic enzymes, resulting in a clinically visible fibrotic changes of the gingiva. (As seen in Figure 1 & 2). This clinically apparent gingival hyperplasia by fibrosis is commonly referred to as gingival enlargement and these lesions are unique in their pathogenic mechanisms.[2]

Drug-induced gingival enlargement (DIGE) is the most studied cause of these lesions with anticonvulsant medication being highly implicated. There are a variety of

Figure 6: Shows gingival tissue improvement on the lingual and palatal aspects.

Figure 7: Gingivectomy was performed to eliminate excess gingival tissue. An external bevel incision was performed since there is keratinized mucosa of more than 5mm. Note the gingival recession on the 13 area, which was not considered for treatment at this particular stage, however possible procedures for recession coverage were discussed with the patient.

Figure 8: Shows a completed treatment of the gingival hyperplasia as a main complaint. The gingival recession was left untreated upon request by the patient.

reasons a patient may present with gingival enlargement; this article focuses on only the drug-induced variants with emphasis on phenytoin. [2]

4.1 Aetiology and Classification of Gingival Enlargement

Gingival enlargement cases can be classified according to the associated aetiologies as follows: Inflammatory enlargement following an acute or chronic case of gingivitis, drug-induced gingival enlargement (DIGE), gingival enlargement associated with systemic conditions, gingival enlargement associated with neoplasms and false enlargement.[3] Although not discussed further here, it should be noted that gingival enlargement may also be associated with life-threatening systemic diseases such as leukemia and thus a comprehensive examination to reach a diagnosis is of great importance.[2, 3]

Three drug groups have been identified as to be commonly associated with DIGE namely: antihypertensives (calcium channel blockers), anticonvulsants and immunosuppressants. DIGE will be the focus of this article.

Table 1: Numerous aetiologies of gingival enlargement have been identified.

Aetiologies and classification of gingival enlargement	
1.	Inflammatory enlargement
	A. Chronic Acute
2.	Drug induced gingival enlargement (DIGE)
3.	Enlargement associated with systemic disease or conditions
	A. Conditioned enlargement
	• Pregnancy
	• Puberty
	• Vitamin C deficiency
	• Plasma cell gingivitis
	• Non-specific conditioned enlargement (e.g., pyogenic granuloma)
B.	Systemic diseases causing gingival enlargement
	• Leukemia
	• Granulomatous disease (e.g. Wegener's granulomatosis, Sarcoidosis)
4.	Neoplastic enlargement
	A. Benign
	B. Malignant
5.	False enlargement

4.2 DIAGNOSIS

Since it has been established that gingival enlargement is usually associated with systemic conditions, including medical physician's input on the overall examination becomes very important in reaching a correct diagnosis and ultimately adequately addressing the presenting main complaint.[3]

Reaching an accurate diagnosis requires a comprehensive review of the presenting medical history and a precise clinical presentation must be categorised in either a localised or generalised distribution of the lesions. The localized form may only be confined to papillae or involve thirty percent or less of the entire gingival tissue while the generalised gingival hyperplasia involves usually the entire gingival tissue. Clinically the affected gingiva develops a thickened, lobulated appearance. The gingival enlargement can progress to eventually completely cover the anatomic crowns of teeth. Associated symptoms may include pain, tenderness, bleeding and discomfort during mastication.[4]

During a dental examination the degree of gingival enlargement can be scored according to table 2 below:[2]

Table 2

Gingival Enlargement Clinical Scoring	
Grade	Description
Grade I	No signs of gingival enlargement
Grade II	Enlargement confined to interdental papilla
Grade III	Enlargement involves papilla and marginal gingiva
Grade IV	Enlargement covers three-fourths or more of the crown (Figure 1)

4.3 DRUG-INDUCED GINGIVAL ENLARGEMENT (DIGE)

The most implicated drugs in development of gingival enlargement are used in treatment of serious disease including antihypertensives, anticonvulsants and immunosuppressants. Three drugs associated with gingival enlargement (mentioning the most encountered during a dental consultation) are nifedipine, phenytoin and cyclosporine.[3]

DIGE generally presents 3-6 months after the onset of the use of these medications.[4] It should be noted that not all patients being treated with these drugs will ultimately develop hyperplastic enlargement of the gingival tissues in the oral cavity.[1,2] A common observation in the development of DIGE is that the event is secondary to poor general hygiene of the oral cavity resulting in the accumulation of an undisturbed biofilm and ultimately inflammation of the gingiva.[3] The host responds by fibrosis of the gingival tissues. The degree of inflammation and fibrosis is heavily dependent on the type of drug used, dosage, and duration of drug use and oral hygiene status of the patient. It may also depend on the individual susceptibility including genetic factors together with environmental factors.[3]

4.3.1 Anticonvulsants

Phenytoin (diphenylhydantoinate) is an anti-epileptic drug, also called an anticonvulsant. It works by slowing down impulses in the brain that cause seizures. In South Africa it is a drug of choice in the treatment of grand mal, psychomotor and temporal lobe seizures. The estimated prevalence of this type of DIGE is about fifty percent of the global population.[4]

The onset of gingival enlargement is observed as early as one month after the onset of drug prescription. The increase in the lesion severity progresses with the increased duration of drug use. The buccal gingiva of both the maxilla and the mandible are the commonly affected sites, but an involvement of the entire dentition may be observed in severe cases (Figure 1).[4,5]

Major characteristics of these type of DIGE are the increase in tissue volume of the interdental papillae and thickness of the marginal gingiva resulting in the functional and aesthetic concerns.[6]

4.3.2 Antihypertensives (calcium channel blockers)

This group of drugs are mainly used to treat hypertension, coronary artery disease, angina pectoris and cardiac arrhythmia.[19] Phenylalkylamine derivatives (e.g., verapamil), Benzothiazepine derivatives (e.g., diltiazem), and dyhydropyridines (e.g., amlopidine, nifedipine, nisoldipine) are different types of drugs implicated in the development of gingival hyperplasia.[7,8]

4.3.3 Immunosuppressants

Immunosuppressants are widely used for the prevention of solid organ and bone marrow transplants and for the treatment of autoimmune disorders. Cyclosporin A is a widely used agent in most of the cases.[9] These lesions are characteristically limited to the buccal aspect of both the maxilla and the mandible. The severity may be just as like that of phenytoin.[3,9]

4.4 PATHOGENESIS OF DRUG-INDUCED GINGIVAL ENLARGEMENT

The mechanisms leading to DIGE is mediated through defective functioning of the fibroblast in the gingival tissues. The implicated medications directly affect the metabolism of the extracellular matrix by reducing enzymatic activity of collagenase while elevating the production of matrix proteins.[3]

Over and above the effects imposed by these drugs on the fibroblast, the host inflammatory regulation of tissue turnover becomes the major factor in the pathogenesis of gingival enlargement.[6]

Studies evaluating tissues from gingivectomy procedures have demonstrated some differences in the cellular and molecular features in the tissues depending on the type of drug the patient was prescribed.[6] Gingival enlargements associated with phenytoin demonstrates more fibrosis;

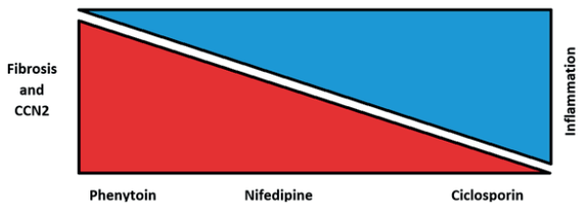

Figure 9: Relationship between inflammation, fibrosis and medications associated with gingival enlargement. The left side demonstrated high levels of fibrosis accompanied by high expression of CCN2 (also known as connective tissue growth factor – CTGF). The right side represents high inflammation and lower levels of fibrosis.[21]

cyclosporin affected tissues present with more inflammation and less fibrosis, while nifedipine induced enlargement are mixed.[6]

Hassell et al, in 1991 suggested that in phenytoin-induced gingival enlargement the fibroblasts are characterised by the increased synthesis of the collagen. They further deduced that gingival fibroblast from nifedipine-induced gingival hyperplasia have defective production of collagen resulting from reduced collagenasese activity also resulting in deposition of collagen.[9]

Tipton *et al,.* in 1994 concluded that calcium channel blockers decrease calcium levels in gingival fibroblast and T cells though the process of interfering with the metabolism of calcium. This results in interference in the T-cell proliferation and/or activation and biosynthesis of collagen.[10]

Cyclosporin appears to promote inflammation and tissues fibrosis by initiating an exaggerated innate immune response and has anti-fibrotic effects on collagen biosynthethesis and deposition.[21] Cyclosporin targets cyclophilin, subsequently disrupting collagen deposition and maturation in part by inhibition of prolyl-3-hydroxylase activity.[21]

The functions of fibroblasts such as proliferation, differentiation and synthesis of extracellular matrix are regulated or controlled by levels of host cytokines and growth factors.[5, 9, 10, 19] Molecular studies on tissues with drug-induced gingival enlargement are typically characterised with elevated levels of platelet-derived growth factors (PDGF), interleukin-6, interleukin-1β, transforming growth factor-β (TGF-β), fibroblast growth factor 2 (FGF2) and connective tissue growth factor (CTGF).[11, 16] Macrophages are the main source of these cytokines and the TGF-β1-CTGF pathway has well been noted as an essential mechanism resulting in the formation of gingival enlargement.[12]

TGF-β is found in high concentrations in platelets, macrophages, neutrophils and fibroblasts. TGF-β acts mainly on fibroblasts and endothelial cells and results in collagen and matrix synthesis.[15]

CTGF (also known as CCN2) is a reliable marker of fibrosis and contributes to development of fibrosis initiated by TGF-β. 15 CTGF is synthesized by endothelial cells and fibroblasts and has mitogenic and angiogenic functions. CTGF acts as autocrine growth factor in response to TGF-β. 15 Cellular proliferation and differentiation in the gingival tissues is regulated by TGF-β1 and may activate gene expression for the synthesis of extracellular matrix components.[13, 17] TGF-β1 induces connective tissue growth factor mRNA and protein expression in human gingival fibroblasts. The TGF-β1–CTGF pathway directly regulates fibrosis, gingival fibroblast lysyl oxidase, and collagen generation. CTGF expression is increased in all forms of gingival enlargement, with the highest levels occurring in phenytoin-induced gingival overgrowth.[13, 18]

The expression of the CTGF is not only limited to the connective tissue but also demonstrated in the gingival epithelium in abundance around the basal epithelial cells.[14] Black SA et al, 2007 revealed a unique mechanism for TGF-β1- induced CTGF expression in fibroblast regulated by prostaglandin E2, mitogen-activated protein kinases (MAPKs) Camp and activation of Jun N-terminal Kinases (JNKs).[15]

This is a key event in the pathogenesis of DIGE in some degree of epithelial-mesenchymal transition induced by medication.[3, 6, 8, 15] Elevated levels of fibrosis on soft tissues is characterised by the elevated epithelial-mesenchymal transition, through which fibroblast function is acquired by epithelial cells in the gingiva, the process is regulated by CTGF. [14]

Phenytoin has also been found to suppress extracellular matrix-degradation by inhibition of lysosomal enzymes (cathepsin I, matrix-metalloproteinase-1, tissue inhibitor of matrix metalloproteinase-1). Through this mechanism there is suppression of extracellular matrix and collagen degradation.[21]

Phenytoin may also cause a decrease in sodium and calcium flux, as well as a reduction in cellular folic acid uptake. This subsequently results in a localized folate deficiency in the gingival tissue – which can cause degenerative changes in the sulcular epithelium and may also exacerbate inflammation. [21]

4.5 MANAGEMENT

Gingival enlargement causes significant difficulties for patients to maintain their oral hygiene. This gross enlargement of the gingiva can also results in difficulties with mastication, poor aesthetics and can negatively impact the patients quality of life and overall health.[22] The presence of gingival inflammation associated with poor oral hygiene and plaque accumulation, serves as a major risk factor to the onset and worsening of DIGE. [20, 21]

Non-surgical periodontal therapy has reported to be able to reduce the size of the clinical lesions by up to 40%, due to the removal of bacteria and the resultant reduction in tissue inflammation.[22] In most cases (approximately 60 %) the fibrotic gingival enlargement requires surgical intervention. Studies have reported that up to 34% of cases can present with recurrence after 18 months following non-surgical and surgical periodontal therapy. [23] Some studies have reported that alternative surgical interventions (such as the use of a laser excision) can result in reduced recurrences compared with conventional gingivectomy techniques.[23] Long-term maintenance and follow-up of these patients remains essential due to the continuous use of the associated drugs.[22] It has been demonstrated that if a patient is placed on a preventative dental program and effective oral hygiene is maintained, the occurrence of DIGE can be minimised.[23]

Some animal studies have been conducted evaluating the potential use of statins in preventing phenytoin-induced gingival enlargement.[32] This is based on the findings that statins inhibit HMGCoA reductase, which is required for the biosynthesis of mevalonate-derived active geranylgeranylated RHO family small G-proteins, including RAC1, CDC42 and RHOA. Active RAC1 and CDC42 are uniquely required for TGF-β stimulated CCN2 (CTGF) levels in gingival fibroblasts.[19]

4.6 RECOMMENDATIONS

DIGE is an adverse effect of drugs used to treat serious systemic conditions that may at times be life threatening, it would be a good clinical practice that medical and dental

teams work together to maintain patients who take the implicated drugs.[20]

Patients taking these medications should be adequately educated on the potential adverse effects on the oral cavity. The patients at risk for DIGE need to be monitored frequently with a thorough full-mouth debridement to reduce any inflammation of the gingival tissues and be placed on a strict homecare oral hygiene regimen.

5. TEACHING POINTS

- When prescribing drugs that can potentially induce gingival hyperplasia, involvement of oral and dental care is advocated
- Good oral hygiene habits may prevent secondary induction of drug-induced gingival hyperplasia

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Cornu cutaneum in the maxillofacial region – A case report

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ABSTRACT

Aim

Cornu cutaneum are horn-like skin protrusions comprised of dense keratin. They differ from animal horns in a sense that cornu cutaneum do not have a central bone. The lesions may develop in any part of the body, with 30% of the lesions occurring in the head and neck region. Although they are considered benign lesions, they are characteristically associated with pre-malignant or malignant lesions such as squamous cell carcinoma, actinic keratosis, keratoacanthoma, basal cell carcinoma and Kaposi sarcoma. The aim of this clinical case report is to review a case of cornu cutaneum of the face associated with papillary squamous cell carcinoma in a 72-year-old female

Materials and methods

We reviewed a case of cornu cutaneum of the left pre-auricular area of the face with a 5-year history.

Results

The lesion was asymptomatic, measured 6cm in length and was resected under general anaesthetic with wide margins. The histopathological examination showed papillary a squamous cell carcinoma at the base of the lesion. As the lesions are benign and the nearest margin was 9mm, no further adjunct therapy was instituted.

Conclusion

Although considered a benign lesion, cornu cutaneum is invariably associated with malignant lesions such as squamous cell carcinoma. Similarly, our case was associated with a papillary squamous cell carcinoma at the base of the lesion. As per current standards, the lesion was resected with wide margins.

Keywords

- Cornu cutaneum
- Maxillofacial region
- Benign
- Premalignant
- Malignant
- Surgical excision

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Author's contribution:

EN Nokaneng	60%	conceived the case report and prepared, reviewed and edited the final manuscript for submission.
SS Nkosi	40%	literature review and drafting of the manuscript. All authors read and approved the final manuscript

Conflict of interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

INTRODUCTION

Cornu cutaneum (cutaneous cornu) are horn-like skin protrusions formed by dense keratin.[1,2,3] A distinctive feature that distinguishes cornu cutaneum from an animal horn is the lack of central bone found with the animal horn.[1] The lesions may develop in any part of the body, with a 30-35% and 31% occurring in the head and neck and upper limbs respectively.[1,4,5]

Yu *et al.*, suggested that cornu cutaneum is not a pathological diagnosis as it is derived from an underlying benign, pre-malignant or malignant lesion.[1] Indeed, the observation was supported from large case series reports that found that the lesions are associated with benign and malignant lesions such as squamous cell carcinoma, viral warts, actinic keratosis, keratoacanthoma, Bowen's disease, seborrheic keratosis, basal cell carcinoma and Kaposi sarcoma.[4,6]

The pathogenesis of the cornu cutaneum is not known.[7] However, cornu cutaneum is associated with the sites susceptible to actinic injury such as face[4] thus actinic keratosis, molluscum contagiosum, arsenic keratosis, squamous cell carcinoma, basal cell carcinoma as well as previous skin malignancy are considered risk factors.[2,6,8]

Therefore, the aim of this clinical case report is to review a case of cornu cutaneum of the pre-auricular area of the face associated with papillary squamous cell carcinoma in a 72-year-old female.

Case report

A 72-year old female presented with 5-year history of a pedunculated lesion on the left pre-auricular area of the face. The lesion was generally asymptomatic with a few exceptional occasions when the lesion caught onto her clothes. No history of trauma or previous malignancy was elicited. She had a well-controlled hypertension with no previous surgical history.

Figure 1. Cornu cutaneum on the left pre-auricular area.

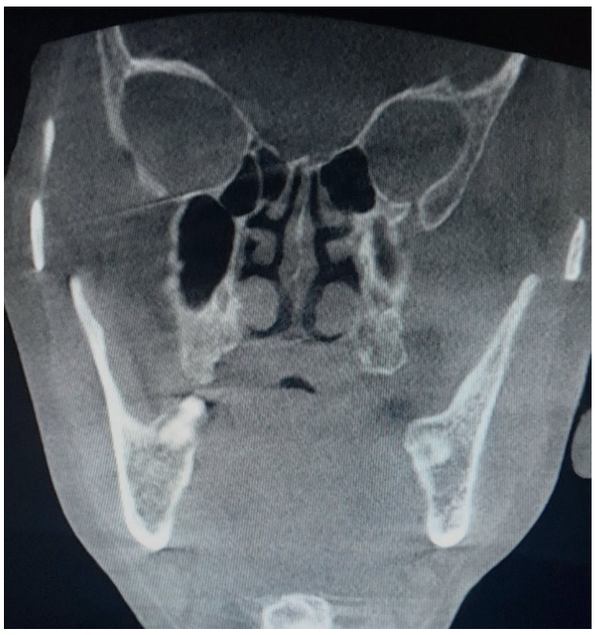
Figure 2. Cone beam computed tomography of the lesion.

Clinical examination revealed a solid, exophytic and non-tender horn-like lesion; grey- white- black in appearance with brown vertical striae. The colour and texture skin at the base of the lesion was similar to the peripheral skin. Furthermore, the lesion was 6cm in length (Figure 1). There was no regional lymphadenopathy. An ultrasound and radiographic examination did not reveal any abnormalities associated with the lesion (Figure 2). Interestingly, the ultrasound showed that the base of the lesion was avascular. Based on the clinical and radiographic features a provisional diagnosis of a cornu cutaneum was made. The pre-operative investigations included full blood count, urea and electrolytes and the findings were unremarkable.

The lesion was excised under general anaesthesia with 10mm margins and closure of the defect was achieved with a bilateral Z-plasty. There were no peri-operative complications and patient had an uneventful recovery. On her 30-days follow-up, the wounds had healed uneventfully (Figure 3).

Histopathological examination revealed a completely excised cornu cutaneum with papillary squamous cell carcinoma at the base of the lesion. There was also extensive hyperkeratosis and micro-invasion of atypical cells into the underlying dermis (Figure 4). Perineural and lymphvascular invasion were not discernible. As cornu cutaneum are benign lesions and the nearest peripheral and deep resection margins were 9mm and 10mm, no adjunct therapy was instituted.

DISCUSSION

Cornu cutaneum (cutaneous cornu) is a horn-like skin protrusions formed by dense keratin.[1,2,3] A distinctive feature that distinguishes cornu cutaneum from animal horn is the lack of the central bone found with the animal horn.[1] The lesions are composed of keratin excretions.[9] The lesions may develop in any part of the body, with a 30-35% and 31% occurring in the head and neck and upper limbs respectively.[1,4,5] Commonly, cornu cutaneum appears as a solitary lesion. However, the presence of multiple lesions in an individual have been reported.[6,10] Similarly, in our case, a solitary cornu cutaneum was found on the left pre-auricular area of the face.

The aetiopathogenesis of the cornu cutaneous is not known.[7] However, cornu cutaneum are associated with the sites susceptible to actinic injury such as face and upper extremities.[2,4,6] Furthermore, the association of cornu cutaneum with lesions resulting from actinic injury such as actinic keratosis, molluscum contagiosum, arsenic keratosis, squamous cell carcinoma, basal cell carcinoma suggests that actinic injury may be a predisposing factor.[2,6,8] This also accords the findings by Copcu et al. who reported sun exposure as risk factor for cornu cutaneum.[2] Copcu et al. reported in their case series, that all (n=11) patients with cornu cutaneum had solar keratosis on face and extremities associated with a history of long-term sun exposure.[2] Oludiran and Ekanem also suggested there may be a racial predisposition to cornu cutaneum as the majority of the


Figure 3. Post-operative follow-up (30-days).

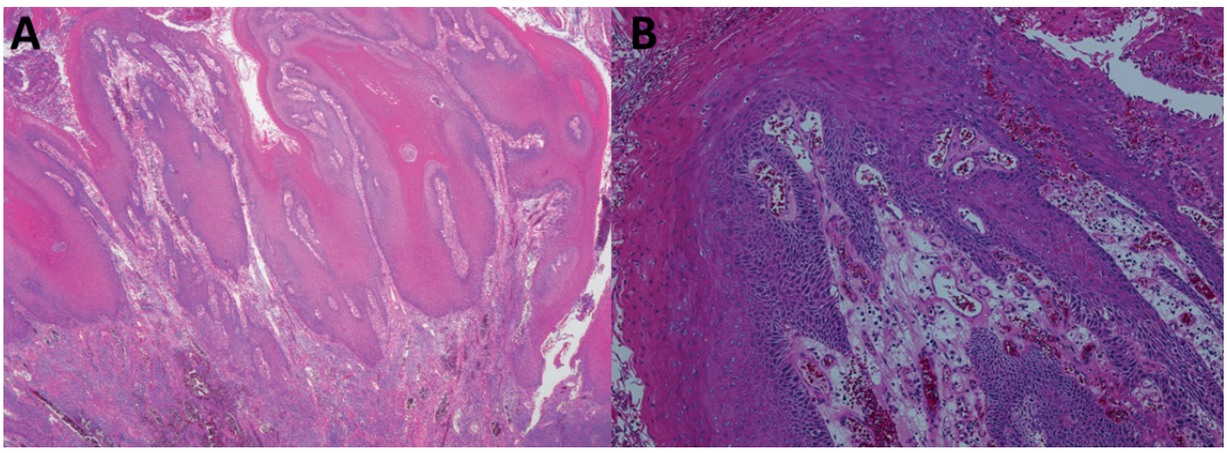

Figure 4 (A and B). Histomicrograph showing the palisaded squamous cell carcinoma with atypical cell invasion of the dermis (H&E stain: x 200 magnification).

reported cases are from Caucasian individuals who are more susceptible to actinic injury.[5] However, the dearth of data from individuals of African descent may be as result of underreporting. On the other hand, repeated trauma has also been suggested as an aetiological factor.[11] In our case, there was evidence of solar elastosis on histological examination suggesting that actinic injury could have been an aetiological factor.

The taxonomy of cornu cutaneum refers to the morphological description of the lesion.[1,6] However, histologically the lesion may be classified as benign, premaligant or malignant as dictated by the base lesion.[6] Cornu cutaneum are predominantly benign lesions (61.1%; n=393/643 and n=37/48;77.1% respectively).[1,6] On the other hand, Mantese et al. found that 51.4% (n=114) of the lesions were pre-malignant.[4] As a result, several authors have cautioned that one should have a high index of suspicion in individuals with cornu cutaneum due to the pre-malignant or malignant histological features.[2,4,5,6,9,10] Therefore, the histological characteristics define the final diagnosis of the lesion.

Several authors have related the duration of the development of cornu cutaneum and the size of its base with the histopathology features. Observations have shown that chronic and wide-base cutaneous cornu have a higher risk of being premalignant or malignant.[1,4] However, further studies are required to validate the significance of the size of the base lesion to the overall histological features of the lesion.

The diagnosis and management of cornu cutaneum is primarily dictated by the diagnosis of the base lesion.[6] However, the diagnosis of the base lesions may be challenging due to the heterogeneity of histological presentation.[6,7,12] Consistent with the literature, we found papillary squamous cell carcinoma at the base of the lesion with micro-invasion of the atypical cells into the underlying dermis as well as evidence of solar keratosis.

Surgical excision with wide margins is the suggested gold standard.[2,5,6] Mencía-Gutiérrez et al. suggested a wide margin of 3mm of tumour free margins whereas Kumar et al. suggested a 10mm margin.[6,9] The definitive treatment is dependent on the final histological diagnosis of the lesion.[7] However, adjuvant therapy is not recommended as recurrence is rare.[5,6,13] Similarly, our patient did not receive adjuvant therapy and will be closely monitored for potential recurrences.

CONCLUSION

Although considered a benign lesion, cornu cutaneum is invariably associated with malignant lesions such as squamous cell carcinoma and basal cell carcinoma.[2,4,5,9,10]

Similarly, our case was associated with a papillary squamous cell carcinoma at the base of the lesion. As per current standards, the lesion was resected with wide margins with no adjuvant therapy instituted.

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What's new for the clinician – summaries of recently published papers (April 2023)

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1. WHAT EVERY ORAL HEALTH PRACTITIONER SHOULD KNOW ABOUT HOW TO EXAMINE PATIENTS WHO HAVE DENTAL IMPLANTS

Dental implants are a common treatment modality that is offered to many patients. There is therefore a good chance that many oral health professionals (dentists, dental therapists, oral hygienists, dental specialists) will encounter such patients in their private or public dental clinics. Barrak and colleagues (2023)[1] have highlighted the mismatch between the knowledge and skill requirement of the general dental practitioner (GDP) in managing such patients and the training provided at undergraduate (UG) and general postgraduate (PG) levels. Studies in the UK among dental schools there and in Ireland have shown that most schools provided lecture-based information with no clinical training at undergraduate level on implant dentistry. This, despite the fact that most implants were in fact placed by dentists who had little training in their undergraduate training.

In our local setting, dental implants are being placed in a wide range of clinical settings, and as a result, general dentists and other oral health professionals will inevitably come across patients who have received implant therapy and should therefore be examining dental implants. This will demand a minimum standard for implant training at undergraduate (UG) and postgraduate (PG) level in order to be able to provide the required professional care.

On review of the dental literature, the terms success and survival rates have been a source of confusion for many years.[1] According to the International Team of Implantology (ITI), the definition of survival indicates the implant is simply present at follow-up but its condition is not specified; while the definition of success indicates the presence of the implant at the follow-up appointment and complications are absent.[1]

Several factors can therefore influence the long-term survival of dental implants. Both biological and technical complications can affect the clinical outcomes of dental implant therapy. Biological complications involve inflammatory conditions, such as peri-implant mucositis and peri-implantitis,[1] as well as soft tissues lesions, such as pain, swelling, hyperplasia and fistula formation.[1] Technical complications affecting dental implants include: i) fracturing of the implant itself; ii) fracture of veneering material; iii) abutment or screw loosening; and iv) loss of retention.[1] It is also clear from the literature that dental implants can and do fail. Failure can be classified as early or late. Early implant failure occurs as a result of unsuccessful osseointegration, while late failure occurs after successful osseointegration.[1]

One of the major causes of late implant failure has been attributed to peri-implantitis,[1] which can progress from peri-implant mucositis if not controlled. Therefore, in order to ensure long-term stability of a dental implant, it is vital to monitor and maintain their peri-implant health, as well as to identify and treat any associated disease as soon as possible.[1]

Dental professionals would benefit from having access to an easy-to-use checklist on how they should examine a dental implant and recognise potential problems in the primary dental care environment, thereby improving early diagnosis of peri-implant mucositis, peri-implantitis and the long-term prognosis of the implant.

Any patient referred for elective implant treatment must have all underlying active dental disease diagnosed and stabilised or treated before implant therapy.[1] Stable oral health also includes a stable occlusion and good periodontal health. A short period of 3-6 months for reviewing and recording evidence of periodontal status may miss fluctuations in periodontal health (bleeding on probing [BOP] and pocket depths), reflecting the variability in the patient's control, motivation and physiological ability to maintain such high levels of periodontal health. Implant treatment in the presence of active periodontal disease is contraindicated due to the increased risk of peri-implantitis, hence the need to stabilise the patient's periodontal health before commencing implant treatment.[1]

Guide to examining the dental implant patient: 10-point checklist for the general oral health practitioner

There are risk assessment tools for biological complications around dental implants by Heitz-Mayfield, also referenced in the ITI treatment guide. Barrak and colleagues (2023)[1] have suggested a ten-point checklist for the general practitioner (dentist, oral hygienist, dental therapist) to use when recording the clinical notes, with a view to help with an accurate history of implant health status and identification of any events which would demand interventional steps.

The following is a **mnemonic** to help with remembering the ten points of the implant examination checklist: ***Safety Is Overseen By Dentists On Monitoring Clues From Reviews***.

1. Satisfaction

Practitioners should record whether the patient is happy with the prosthesis or if they have any symptoms or complaints. Factors affecting patient satisfaction may include the prosthesis itself (overall shape and shade, clean ability), as well as the soft tissue aesthetics (presence of black triangles, any metal show-through in the gingival tissues).

2. Inflammation in surrounding tissues

This refers to any sign of inflammation and tenderness of the adjacent alveolar region surrounding the implant site. It may be an indication of inflammation within the coronal aspect of the gingival tissues or along the length of the fixture within the alveolus (indicative of peri-implant mucositis or peri-implantitis). Such findings would require further investigation with a periapical radiograph, detailed pocket charting and a referral to the clinician who placed the implant or someone with further training in the management of dental implants.

3. Oral hygiene

Poor oral hygiene is a good indicator for future peri-implant disease. Plaque accumulation onto implant surfaces results in peri-implant mucositis. Retrospective evidence indicates that, if untreated, peri-implant mucositis can convert into peri-implantitis.[1] There is a lack of evidence for an accepted standard of care; there the authors that have suggested that tailored oral hygiene regimes should be implemented for each patient, considering both mechanical and chemical plaque disruption. Such regimes would have to consider the number of implant fixtures and the types and designs of prostheses being placed, as this will ultimately influence the type of patient-performed cleaning that will be required. For instance, a single implant crown will require the use of toothbrushes and interdental brushes, while an implant-retained bridge may require the use of super floss as well.

4. Bleeding on probing (BOP)

The Consensus report of the sixth European workshop of periodontology highlighted that it is essential to probe dental implants.[1] Practitioners can be reassured that conventional probing with light force (0.25N) does not harm the peri-implant tissues[1] and is recommended at least once a year.[1] Both plastic and metal probes can be used.

BOP is a key early indicator of disease and is associated with several risk factors, including poor oral hygiene, cigarette smoking, a history of periodontal disease, excess cement and prosthetic design.[1] However, it is difficult to distinguish between BOP caused by peri-implant inflammation and induced by trauma from probing. It is important for the GDP to recognise and record such findings in the clinical notes and to educate their patients on behavioural changes.

5. Deep pockets

Pocket depths around healthy implants should generally be <5mm in depth. Recording the probing depth at the time of fitting the restoration is vital for providing a baseline record which can be used as a reference point for future comparisons and diagnosis of peri-implant disease. In the absence of baseline records (periapical radiograph, pocket depths and bone levels), peri-implantitis may be diagnosed when radiographic evidence of bone loss ≥3mm from the implant neck and probing depths ≥6mm in conjunction with bleeding and/or suppuration is recorded.[1]

6. Occlusion

As implants lack a periodontal ligament, they also lack the 'shock absorbing' ability of natural teeth.[1] Recording an occlusal examination is vital in the assessment of dental implant restorations. This should be completed at the restoration appointment, as well as at future review appointments, as naturally, a patient's occlusal scheme may change (that is, in the case of tooth surface loss or where dental extractions occur). An occlusal assessment should include both static and dynamic functions. The patient's static occlusion would consider the function of the implant prosthesis during maximum intercuspation, while dynamic functions include anterior protrusive and lateral excursive movements. The occlusal prescription is dependent on the type of implant prosthesis placed. For example, with a single implant in a dentate patient, occlusal contacts in excursive movements may be avoided, whereas in a full arch restoration, this would not be possible. Clinical photographs of the occlusal contacts can be invaluable as a record in the patient notes for monitoring occlusal changes at subsequent appointments. The occlusal assessment should also include any signs of occlusal overload on the implant prosthesis. Furthermore, a review of the natural dentition is also required, highlighting any signs of occlusal wear and mobility. If any change in the occlusion is noted then either a chairside adjustment can be made, or a referral made to the clinician who placed or restored the implant or someone with further training in the management of dental implants.

7. Mobility

Mobility may involve the dental implant fixture itself or the components used to restore it (that is, abutment screw, crown or bridge components). Any mobility should be investigated further and dealt with quickly, as this can rapidly deteriorate, resulting in inflammation, subsequent crestal bone loss and peri-implantitis. Mobility may also lead to fractures of the restorative component (such as the abutment screw). Mobility is best assessed using gentle pressure with an instrument (that is, dental mirror handle) on the implant crown as opposed to direct finger pressure, which can mask or give a false impression of movement.[1]

8. Contacts points

The lack of tight contact points can result in food impaction and subsequent caries in adjacent natural teeth, as well as gingival inflammation, peri-implant mucositis and peri-implantitis. Even if the contact points were perfect at the time of the fit of the prostheses, teeth anterior to the implant can drift mesially, thereby opening a gap for food impaction. Hence, checking for the presence of tight contact points at each implant review is important. The integrity of the contact point can be recorded using clinical photographs and also by using floss or fine (12µm) articulating paper between the contacts and recording this.

9. Framework integrity and emergence profile

Practitioners should review the integrity of the implant prosthesis and also consider the emergence profile of the implant restoration. The peri-implant soft tissue architecture is different to that of a natural tooth, as a lack of Sharpey's fibre attachments to the implant surface results in the peri-implant soft tissues being less resistant to clinical probing and biofilm penetration compared to the natural dentition. Proper restorative emergence profile design is essential to facilitate favourable aesthetic outcomes and maintain peri-implant health

10. Radiograph protocol

Baseline radiographs at fit of the restoration and following a period of loading are required for reference and to aid with future diagnosis of peri-implant disease.[1] If the implant was placed and restored in a different practice, it would be advisable (where feasible) to gain a copy of such radiographs

through correspondence with the clinician responsible for placing and restoring the implant fixture.

If it is not feasible to access a copy of baseline radiographs, it would be beneficial to complete a radiographic assessment of the implant when the patient attends for their examination. Any sign of marginal bone loss needs to be discussed with the appropriately trained clinician and the patient made aware, as further consideration and investigation may be required to ascertain the cause.

In the absence of baseline radiographs, the following three clinical findings are indicative of peri-implantitis: BOP and/or suppuration, with, Pocket depth of ≥6mm, and, Bone loss ≥3mm from the neck of the implant.

Conclusion

Barrak and colleagues have suggested that the key role for the non-implant placing GDP in monitoring implant health is the prevention and early detection of potential peri-implant complications. This is implemented through regular monitoring and maintenance of oral health. Any warning signs detected by using this implant examination checklist should be communicated to the clinician who placed and restored the implant so further investigations or interventions can be implemented sooner. If this is not possible, then a referral to an appropriately trained practitioner would be advised.

Implications for practice

There is a responsibility on every practitioner who examines a patient with an implant to advise the patient on the presence of any sign or symptoms that can have an adverse effect on the implant. Additionally, there is also a responsibility on advising the patient on how to keep the mouth clean and disease free thereby contributing to the longevity of the implant.

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2. DOES ORAL HYGIENE SELF-CARE (OHS) INFLUENCE CARDIOVASCULAR (CVD) MORTALITY?

Although the benefits of good oral hygiene and the use of adjuncts such as flossing and mouthwashes have been shown to have benefits for maintaining a health mouth and teeth, it has not yet been established whether good oral hygiene will result in systemic health benefits. Janket and colleagues (2023)[1] reported on a study that investigated whether oral hygiene self-care (OHS) at baseline was associated with a reduced risk of cardiovascular (CVD) mortality. Additionally, the authors sought to investigate whether mouthwash usage in addition to good OHS would influence its association to CVD mortality in a longitudinal study with 18.8 years of follow-up. They also tested whether mouthwash usage would alter the oral bacterial population.

Thus, the Primary aim of this study was to determine if brushing and flossing affect the risk of CVD mortality in multivariable adjusted models. The Secondary aims were to determine (a) if mouthwash usage has an independent impact on CVD mortality; b) if mouthwash usage affected some periodontal pathogens and cariogenic bacteria proportions.

Methodology

The data for this study was taken from the Kuopio Oral Health and Heart (KOHH) study which ran in Finland from 1995 to 1996 and sought to explore the association between oral health and coronary artery disease (CAD). For the longitudinal part of the study, the mortality data (median follow-up of 18.8 years) were added to the baseline data to create a prospective follow-up study assessing oral infection impacts on CVD mortality. At baseline, 256 consecutive patients attending the Kuopio University Hospital coronary angiography unit and with a confirmed diagnosis of CAD were recruited to participate in the KOHH study. Also, 250 age- and sex-matched controls were recruited from the general surgery or otorhinolaryngology departments at the same hospital. The controls were determined by 'not having heart disease' based on their medical history and the pre-admission tests. The controls resided in the same geographic area where the cases arose. The same exclusion and inclusion criteria were applied to the control subjects.

The CVD mortality data were obtained from the Finnish Death Registry in every year from 2009-2015. The current study used the mortality report of 2015. Using the World Health Organisation's International Classification of Diseases-10 codes, I00 through I99 were considered CVD mortality due to atherosclerotic heart disease and stroke. The reliability of these data was very high, with 99% after comparing the 2009 and 2011 records in a random sample of 100 records.

At the initiation of this study (1995-1996), a single examiner conducted dental examinations. For the current study, the edentulous subjects who cannot floss were excluded. The exposure, that is, OHS, was assessed by questionnaire. Toothbrushing was assessed in four categories: 1) brush once or less frequently a week; 2) brush several times a week; 3) brush once a day; and 4) brush more than once daily. We created a dichotomy of brushing by combining the lower two and upper two groups. Similarly, a dichotomy of flossing was created from the four categories by collapsing the first two and the last two categories: 1) never; 2) once a week; 3) several times per week; and 4) daily.

To assess how mouthwash changes oral microbe proportions, the researchers collected plaque samples from the worst-affected periodontal sites and analysed by rapid multiplex rt-PCR tests using species-specific 16S rRNA gene primers. The periodontal pathogens assessed were *Porphyromonas gingivalis*, *Prevotella intermedia*, *Actinobacillus actinomycetemcomitans* and *Tannerella forsythia*. Similarly, gram-positive microbes were tested from the same plaque samples. The samples were cultured and *Streptococcus mutans* and *Lactobacilli spp*. were identified using the analytical profile index kits (Biomerieux).

Mouthwash usage was assessed by questionnaire. If the patient used mouthwash daily or several times a week, it was considered exposed, and never used or used less frequently than several times weekly were considered as controls. The researchers did not know which patients used what brand, but the brand names of the mouthwashes include chlorhexidine, Listerine (essential oils), products containing 0.05% cetylpyridinium chloride and Meridol (amine fluoride).

Age in years and smoking in three categories (never, past and current smokers) were assessed. Total cholesterol, triglyceride and high-density lipoprotein cholesterol (HDL)

were measured by the automated enzymatic technique. The researchers assessed dyslipidemia by total/HDL cholesterol ratio which was proven the best predictor of future atherosclerosis.1 Diabetes was ascertained by medical record review. Subjects were considered to have diabetes if documented diagnoses were in the medical records or if they were being treated for diabetes. To avoid confounding by affluence and high socioeconomic status, the authors adjusted educational levels, income and private insurance status.

Inflammatory markers such as C-reactive protein (CRP) was measured by immunoturbidimetry. All blood samples were collected after fasting if required and analysed immediately in the hospital laboratory.

Salivary lysozyme (SLZ) levels were also quantified in the oral cavity and used as a marker for oral innate immune activation, which can rupture both gram-positive and gram-negative bacterial cell walls.

Dental plaque scores were created, assigning: 0 = if no visible plaque was present; 1 = if plaque covered gingival 1/3 of the tooth surface; 2 = if plaque covered gingival 2/3; and 3 = if plaque covered the whole surface evaluated. Then, mean dental plaque indices were calculated by summing all plaque indices and dividing by the sum of the surfaces evaluated. Mean gingival bleeding indices were created similarly by summing all surfaces with gingival bleeding and dividing by the sum of the surfaces evaluated.

Results

Of the 506 subjects in the original cohort, 127 edentulous subjects who could not perform flossing (the predictor) were excluded, yielding a sample size of 379. Due to missing values in brushing and flossing data, an additional 25 subjects were excluded and a final sample of 354 was included in the analyses.

In this cohort of 354 dentate subjects, only 57 subjects had good OHS. There were 96 all-cause mortalities accrued in 18.8 years of follow-up and 56 of these were CVD-related, while 40 were non-CVD-related deaths. Of the CVD mortalities, 73% occurred in those who had coronary artery disease (CAD) at baseline and thus safely presumed that CAD is on the causal pathway to CVD mortality. Brushing was highly prevalent, showing 88.2% of the cohort brushed daily while flossing had opposite distribution, showing only 17% flossed daily and 83% did not.

Better OHS led to a longer survival compared with shorter survival associated with poor OHS. The CVD mortality risk was the lowest in the best OHS group (both brushing and flossing) (hazard ratio (HR) = 0.25 [confidence interval: 0.07-0.89]; p = 0.03) and in the brushing only group (HR = 0.72 [CI: 0.37-1.41]; p = 0.34). This suggests that flossing presented significantly greater benefits in CVD mortality reduction than brushing alone. The researchers next tested if this beneficial impact of oral hygiene performance is persistent among those who already had coronary artery disease (CAD) at baseline. In a stratified analysis, the CAD group had a sufficient number of CVD mortality and the observed beneficial effects of OHS remained (HR = 0.50 [0.24-1.06]; p = 0.07).

The effect of independent mouthwash usage on CVD mortality was not statistically significant (HR 0.95 [0.45-2.01]; p = 0.89).

Conclusions

The researchers concluded that brushing and flossing, that is, better OHS, was associated with reduced risk of CVD mortality. However, the additional use of mouthwash did not provide any further advantages or disadvantages to OHS alone.

Implications for practice

The results of this long-term follow-up study s has significant public health importance because brushing and flossing are relatively inexpensive and have low risk of adverse effects. Moreover, even those who already have heart disease can lower the risk of CVD mortality by maintaining good oral hygiene.

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CPD questionnaire on page 166

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.

Is it ethical to immobilize patient's jaws for weight loss? A deontological perspective

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ABSTRACT

The demand for elective aesthetic treatment is increasing globally, in line with aggressive media portrayals of a certain standard of beauty and body image. This trend is also changing the landscape of modern dentistry and is blurring the role of dental professionals as healthcare providers versus aestheticians.

This article explores the ethical dilemma that dental professionals are faced with when patients request a treatment modality such as intermaxillary fixation, to treat a medical condition or enhance aesthetics through weight loss. We evaluate whether intermaxillary fixation for weight loss falls within the dentist's scope of practice from a deontological perspective.

INTRODUCTION

The demand for elective aesthetic treatment is increasing globally, in line with aggressive media portrayals of a certain standard of beauty and body image. This trend is also changing the landscape of modern dentistry and is blurring the role of dental professionals as healthcare providers versus aestheticians.

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Declaration

This article is based on the first author's Masters research report.

One such elective treatment request for weight loss that dental professionals may be faced with is intermaxillary immobilization or fixation, commonly known as jaw wiring.[i] Intermaxillary fixation is traditionally indicated for healing of jaw fractures and in orthognathic surgery. Given that the jaws are immobilized for up to eight weeks, during which the patient is restricted to a liquid diet, one of the side effects of this treatment modality, is weight loss. An interesting, yet underexplored ethical dilemma arises when patients request intermaxillary fixation for the sole purpose of weight loss, either intended for enhancement of physical appearance, for health-related reasons, or both.

This article explores the ethical dilemma that dental professionals are faced with when patients request a treatment modality such as intermaxillary fixation, to treat a medical condition or enhance aesthetics through weight loss. We evaluate whether jaw wiring for weight loss falls within the dentist's scope of practice from a deontological perspective. In brief, deontology is derived from the Greek word 'deon' which means that which is obligatory.[1]

Deontology is a philosophical theory which bases morality on foundational principles of obligation and duty.[2] In contrast to utilitarianism, deontology is not focused on the consequences of a particular action, instead it is focussed on the moral duty of an action, in other words what ought to be done. Given that deontology is based on the duties and obligations of an individual, in this article we evaluate the scope of intermaxillary fixation in dental practice with reference to the ethical duties that have been outlined by the Health Professions Council of South Africa (HPCSA) and the legal duties outlined by the South African Law.

This paper begins with an overview of the four deontological theories, briefly outlines the differences between ethics and the law and summarises the duties that dentists have to their patients and to themselves. It then discusses how these duties influence the professional relationship between the dentist and the patient and how these duties in turn, influence the scope of dental practice. To this end, this paper provides clarity on the concepts of professional misconduct and malpractice and analyses the scope of dental practice from a legal perspective using the Health Professions Act (HPA) No. 56 of 1974.

The authors believe that by using the moral theory of deontology, intermaxillary fixation performed independently by dentists for weight loss, falls out of the scope of dental practice. In subsequent publications, intermaxillary fixation performed independently by dentists will be evaluated from a utilitarian perspective and principle-based approach.

OVERVIEW ON INTERMAXILLARY FIXATION

Intermaxillary fixation, first introduced in the seventeenth century, is a treatment modality that is used by dental professionals to treat simple fractures of the upper and/ or lower jaws and for orthognathic surgery.[3,4] The jaw fixation inhibits mouth opening and the patient is confined to a liquid diet for the duration of the treatment which can result in a patient losing weight.[5]

The first studies of jaw wiring for the purposes of weight loss were documented in the 1970s.[6-9] These studies concluded that jaw wiring can be used as a treatment for obesity, if it forms part of an integrated treatment plan.[6-9] The importance of having a multi-disciplinary team approach when using jaw wiring to treat obesity was emphasised in all of the studies.[6-9] Interestingly, jaw wiring is preferred over intestinal bypass surgery because it can be done under local anaesthetic, and it is an inexpensive, non-permanent intervention.[6-9] However, it was also shown that patients who participated in these studies struggled to maintain their weight, following the removal of the wires.[6-9]

Amongst the most significant risks associated with jaw wiring is pulmonary aspiration of vomitus.[10-11] Since the patient's jaw is wired shut, if they vomit, there is a risk that they will not be able to expel the vomit from the mouth. This could lead to asphyxiation or a subsequent aspiration pneumonia, both of which could be life threatening.[10] Although aspiration and asphyxiation are the most challenging risks associated with jaw wiring, the risk of these happening is exceptionally low.[10,12] Patients can be trained to correctly position themselves when vomiting to avoid pulmonary aspiration and can be trained to cut the wires in an emergency.[6,10,13]

Other risks associated with intermaxillary fixation relate to the damage of teeth that have been wired, or to the surrounding oral structures.[10] Oral hygiene measures are difficult leading to gingival inflammation and later periodontal disease.[14,15,16.17] In addition, patients may experience decalcification of enamel, and halitosis due to the difficulty in maintaining oral hygiene around the wires and brackets.[10,17] Furthermore, temporomandibular joint dysfunction (TMD) could also result from having the jaws wired.[10,15] However, the detrimental effects of intermaxillary fixation on the oral cavity are not permanent, since the gingival and periodontal effects can be reversed, and the gingival health can be restored post removal of the wires.[14,18,19] Even though the detrimental effects of jaw wiring on the oral cavity may not be permanent, jaw wiring does have a negative consequence on the oral health of the patient for the duration of the procedure.

OVERVIEW OF DEONTOLOGY

Deontology is a philosophical theory which bases morality on foundational principles of obligation and duty and can be broadly subdivided into four duty theories.[2] These four duty-based theories are:

- Deontological theory advanced in the 17th century by Samuel Pufendorf, a German Philosopher.[2] He divided duties into three different groups namely, duties to God, duties to oneself and duties to others.[2]
- Rights-based theory defines a right as "a justified claim against another person's behaviour".[2]
- Kant's theory is founded on the principle that rational persons are worthy of basic respect simply by virtue of being human".[20] The German Philosopher, Immanuel Kant proposes that all our duties are based on one main principle – the Categorical Imperative.[20]
- Ross's prima facie theory of duties was founded by the British Philosopher W. D. Ross in the nineteenth century. He based his moral theory on a list of seven prima facie duties. These duties are not absolute and can be over-ridden by other duties when the duties conflict with each other. According to Ross, "these duties are a part of the fundamental nature of the universe".[2]
- An evaluation of the four theories falls outside the scope of this article, thus this paper focuses on the moral and legal duties of the dentist laid down by the HPCSA and the National Health Act (NHA) which are analysed within the context of the topic. Since this section is focused on the moral duties, legal duties and rights of the dentist and patient, it is necessary to explore the relationship between ethics and law.

ETHICS AND THE LAW

Ethics and the law are similar in that they both guide actions. Law however, is enforced by government and is described as the minimum standard of ethics which guides actions.[21] The law leaves no room for choice and non-compliance with the law carries penalties.[21] Ethics on the other hand, comes from an individual's moral sense and it gives that person options that guide their moral decision-making process.[21] In other words, law dictates the actions that we are obliged to follow, ethics guides the actions that we ought to do.[21]

When considering the scope of dental practice in terms of deontology which is based on the duties and obligations of an individual, one needs to investigate if jaw wiring falls within the scope of dental practice, especially when carried out for issues such as weight loss and not as a therapeutic solution for fractured jaws.

The HPCSA was established to regulate the education, training and registration of healthcare professionals that have been registered under the Health Professions Act (HPA) and ensures that the healthcare professionals uphold and preserve ethical and professional standards.[22] The HPCSA also investigates complaints lodged against healthcare professionals and takes the necessary disciplinary action against any healthcare professional when they do not comply with the ethical and professional standards expected from them as professionals.[22]

DUTIES OF DENTISTS

The HPCSA defines duty as "an obligation to do or refrain from doing something".[23] To have a duty to another individual means having an obligation to them.[23] Duties and rights are interlinked because the duty of one person implies the rights of the other. At the same time those who feel entitled to rights also have a duty to the person enabling their right.[23] Healthcare professionals have moral and legal duties to their patients by virtue of being qualified and licenced professionals trained within their respective fields.23 Legal duties are duties that are imposed by the law that compel healthcare professionals to "adhere to certain procedures and to use a particular skill and care when treating patients".23 Legal duties are imposed by the National Health Act (NHA) (Act 61 of 2003) or the Health Professions Act (HPA) of 1974 and by common law.[23]

Dentists have duties to their patients and to themselves. The list of duties to the patient are extensive and for the purposes of this article, the duties that are directly relevant to intermaxillary fixation for weight loss are reviewed. The primary duty of a healthcare professional is to always act in the best interest of the patient.[23] Given that the weight loss that occurs because of intermaxillary fixation is temporary and there are risks of aspiration vomitus, damage to the teeth and surrounding structures and risks to the general health of the patient, such a treatment modality is not in the patient's best interest. To act in the patient's best interest dentists should avoid abusing the position of power they have over their patients.[23] Dentists also have a duty to provide the patient with all the relevant information with regards to intermaxillary fixation for weight loss, "in a language that the patient understands" and communicated in an appropriate manner that takes into consideration the patient's level of knowledge and their values.[22, 23] Furthermore, dentists have a duty to avoid over-servicing their patients which makes it necessary for them to avoid treatment that does not serve the needs of the patient.[23] The dentist's duties to themselves require that they continuously improve their professional knowledge and skills through continuous professional development programs.[23] The dentist also has a duty to acknowledge the limits of their competence and knowledge and to refer a patient when the treatment the patient requires or requests, falls out of the scope of dental practice.[23] Although dentists are trained to wire jaws, they are not adequately trained to treat, or monitor weight loss.[16] Thus the dentist has a duty not to independently treat patients who require weight loss.

The dentist can participate in the weight loss treatment of obese and overweight patients only when the dentist is a member of a multi-disciplinary team that is made up of physicians, psychologists, dieticians, bio-kineticists and physiotherapists.[16] When the dentist is part of this team of professionals, the dentist's role is not to diagnose or to follow the progress of the patient's weight loss, but the dentist will be responsible for the aspects of treatment that falls within the scope of dentistry.[16] If intermaxillary fixation is proposed as part of the integrated treatment plan that has been agreed upon by the multi-disciplinary team, then the dentist will be responsible for ensuring that the patient has good oral hygiene and that there is no disease or dysfunction within the oral cavity that is caused by the wiring.[23]

MALPRACTICE AND PROFESSIONAL MISCONDUCT

The HPA (1974) defines unprofessional conduct or professional misconduct as "improper or disgraceful or dishonourable or unworthy conduct or conduct which, when regard is had to the profession of a person who is registered in terms of this Act, is improper or disgraceful or dishonourable or unworthy".[24] Section 41 of HPA of 1974 states that "a professional board shall have power to institute an inquiry into any complaint, charge or allegation of unprofessional conduct against any person registered under this Act, and, on finding such person guilty of such conduct, to impose any of the penalties prescribed in section 42".[24] Malpractice is classified as a type of negligence, and medical negligence is the failure of a healthcare professional to exercise the degree of skill and care of a reasonably competent practitioner in the field concerned.[25] Malpractice in dentistry is when the dentist provides treatment which is below the acceptable care and this treatment results in serious personal injury to the patient.[26] If a dentist independently wires a patient's jaw for weight loss, the dentist will be at risk of professional misconduct or a malpractice claim.[16] Regulation 238 (2009), of the HPA (1974) states with regards to dentist's scope of practice that, "clinical examinations are limited to the physical clinical examination of the oral maxillofacial and related structures of a person".[24] Regulation 238 (2009) of the HPA (1974), further states that the dentist's scope is limited to "diagnosis of diseases, injuries and conditions of the oral, maxillofacial and related structures, including determining the relevance of systemic conditions, and/or giving advice on such conditions".[24] It is clear from the above that dentists are restricted to examination and diagnosis of the oral cavity and related structures only. The dentist is not permitted to diagnose or treat systemic conditions, but the dentist is allowed to determine the effects that systemic conditions have on oral health and advise the patient with regards to the oral effects of the systemic condition. Systemic conditions are those conditions which affect the whole body and not an isolated organ or part of the body. Obesity, the overweight condition, and eating disorders are classified as systemic conditions, because it affects the whole body. Thus, according to Regulation 238 (2009) of HPA (1974), the dentist is not allowed to diagnose and treat obesity, the overweight condition and eating disorders.[24]

With regards to clinical procedures, Regulation 238 (2009) of the HPA (1974), states that dentists can, "perform dental procedures and/or prescribing medicines aimed at managing the oral health of a patient, including prevention, treatment, and rehabilitation".[24] Regulation 238 (2009) of the HPA (1974), further states that dentists can "perform any procedure on a patient aimed at fitting or supplying a dental prosthesis or appliance".[24] Dentists manage the oral health of patients and they can fit appliances and prosthesis within the oral cavity. It could be argued that a dentist is allowed to wire jaws for weight loss because jaw wiring is a procedure whereby the dentist is fitting an appliance within the oral cavity.

A counter argument to this could be that Regulation 238 (2009) of HPA (1974) states that the dentist is only allowed to determine the relevance of systemic conditions on the oral health of a patient.[24] Therefore, it could be deduced that the dentist is allowed to wire jaws when the purpose of the treatment is for healing of a jaw fracture because a dentist is allowed to diagnose and treat fractures of the jaws. Nonetheless, the dentist is not allowed to independently wire jaws for weight loss because the dentist is not allowed to treat systemic conditions. The dentist can participate in treating obesity when she or he forms part of a multi-disciplinary team because, the dentist will not be responsible for diagnosing and independently treating a systemic condition.[16] The diagnosis of obesity will be made by the physician and the dentist will only provide the dental services as part of integrated treatment plan.[16]

As for aesthetic procedures, Regulation 238 (2009) of HPA (1974), states that dental practice is limited to, "performing any aesthetic or cosmetic procedure on a patient pertaining to the oral and peri-oral area".[24] Dentists can perform aesthetic work on teeth, gingiva, and any intra-oral area and peri-oral structures. Thus, the dentist is legally not allowed to assist a patient with weight loss for purely aesthetic reasons as the dentist is only allowed to carry out aesthetic procedures within the oral cavity and surrounding peri-oral area.

ETHICAL RULES OF CONDUCT FOR HEALTHCARE PRACTITIONER

The Ethical Rules of Conduct for Healthcare Professionals

which is registered under the HPA defines what sort of behaviour is necessary for a healthcare practitioner to be considered professional. Ethical rule 21 (2006) of the HPA (1974) states that "a practitioner shall perform, except in an emergency, only a professional act for which he or she is adequately educated, trained and sufficiently experienced".[24] Since dentists are not adequately educated, trained, and experienced to treat any metabolic disorders, a dentist who independently wires jaws for weight loss is not adhering to ethical rule 21 of The Ethical Rules of Conduct for Healthcare Professionals. Not adhering to ethical rules of conduct is professional misconduct and thus, if a dentist independently wires a patient's jaws for weight loss can lead to an inquiry of professional misconduct and if the dentist is found guilty the dentist will be subjected to a penalty.

Lastly, according to South African law, if a patient dies due to the negligence of the healthcare professional, the healthcare professional can be charged with culpable homicide.[27] If a patient dies from aspiration of vomitus after a dentist independently wired a patient's jaw for weight loss, the dentist can be charged with culpable homicide.[27]

There are also studies that show an increased mortality rate associated with intentional weight loss in obese patients.[28,29] Jaw wiring for weight loss is a means of intentional weight loss, which means there is a risk that an obese patient can die due to intentional weight loss caused by jaw wiring.[28,29] If this happens a dentist can be charged with culpable homicide. The dentist is justified in overriding the patient's autonomy, when the patient's requests will result in the dentist carrying out treatment which is unethical and illegal.[27]

ADVERTISING

It is both reasonable and necessary for dentists to advertise their professional services to the general public. Dentists are permitted to advertise their professional services, provided it is within the ethical rules. According to the HPCSA , "a practitioner shall be allowed to advertise his or her services or permit, sanction or acquiesce to such advertisement: provided that the advertisement is not unprofessional, untruthful, deceptive or misleading or causes consumers unwarranted anxiety that they may be suffering from any health condition".[22] Advertising the service of independent jaw wiring for weight loss would thus be considered a form of misleading advertising, as it falls falls out of the scope of dental practice.

Furthermore, "a practitioner shall not canvass or tout or allow canvassing or touting to be done for patients on his or her behalf."[22] Canvassing is defined as "conduct which draws attention, either verbally or by means of printed or electronic media, to one's personal qualities, superior knowledge, quality of service, professional guarantees or best practice"[22]. An example would be claiming to be the best dentist in town. Lastly, touting is defined as "conduct which draws attention, either verbally or by means of printed or electronic media, to one's offers, guarantees or material benefits that do not fall in the categories of professional services or items, but are linked to the rendering of a professional service or designed to entice the public to the professional practice".[22] An example of this is using patient testimonials to promote oneself. If a dentist is uncertain about advertising or suspects they may be in violation of the guidelines, they should consult the HPCSA for advice to avoid potential unprofessional conduct.

CONCLUSION

The moral theory of deontology was used to critically analyse if jaw wiring for weight loss falls within the scope of dental practice. Since deontology is concerned with duty and obligation, it was argued that both the ethical and legal duties confirm that when the dentist independently wires jaw for weight loss this treatment falls out of the scope of dental practice because the dentist is not trained to treat metabolic diseases. As per guidelines formulated by the HPCSA, the dentist has ethical duties to themselves and their patients. Regulation 238 (2009) of the HPA (1974) defines the scope of practice for dentists which shows us that when a dentist independently wires jaws for weight loss then this treatment falls out of the scope of dental practice. However, when a dentist forms part of a multi-disciplinary team treating an obese patient, and if the jaw fixation is part of the treatment plan, then jaw wiring for weight loss falls within the scope of dental practice.

Thus, a dentist that independently wires jaws for weight loss or advertises the service, does not adhere to ethical rule 21 (2006) of the HPA (1974) and is at risk of being charged with professional misconduct, medical malpractice, or culpable homicide.

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Case – Calcification of the epiglottis

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L Ebrahim[1], S Shaik[2]

This 70-year-old male patient presented to the Department of Oral and Maxillofacial Radiology for CBCT imaging prior to implant therapy **(Figure 1).**

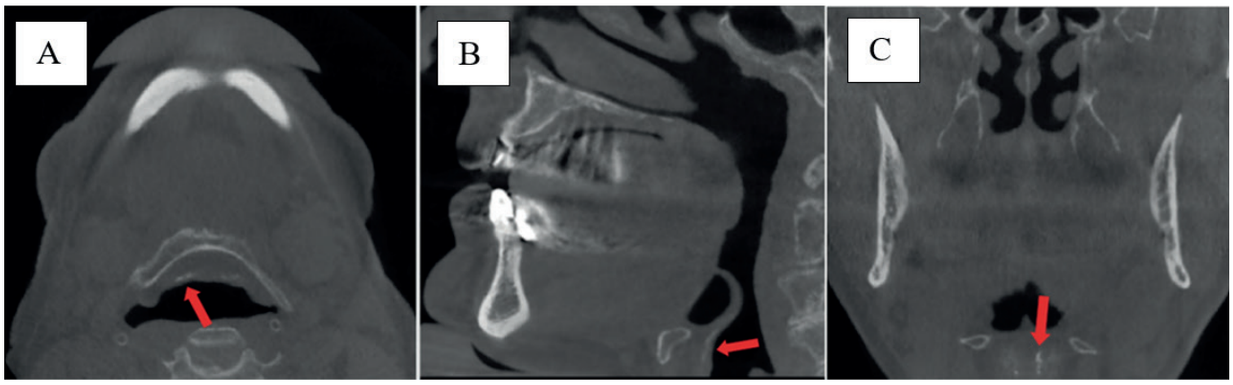

Figure 1: Axial, coronal and sagittal multiplanar reformatted images showing epiglottic calcifications.

INTERPRETATION

The epiglottis play an important preventative role for preventing aspiration and assists in the coordination of swallowing.[1] Epiglottic calcification presenting as single or multiple linear hyper-densities anterior to the airway space and posterior to the hyoid bone on CBCT imaging (red arrows). Calcification of the epiglottis has been rarely documented and is poorly understood. It is thought to be a normal physiological degenerative process and can also be a consequence of infection or trauma.[1,2] CBCT imaging including the inferior border of the mandible and the hyoid bone may allow visualisation of this structure and careful interpretation of the images is therefore advised.

Calcification of the epiglottis may alter its morphology and function (elasticity), leading to symptoms such as dysphagia and/or dysphonia.[1] Extra-osseous calcification is seen in patients with secondary hyperparathyroidism and renal diseases.[1,3] The differential diagnosis for this presentation should include calcifications secondary to granulomatous diseases, calcifications secondary to radiotherapy and calcified tumours of the larynx.[3] Thus, this patient may benefit from close monitoring or haematological tests (including biochemical serum testing for parathyroid hormone, vitamin D levels, calcium, or phosphate levels) to rule out systemic disease.[4] Current imaging referrals include flexible fibreoptic laryngoscopy and further evaluation by pulmonologist. Advances have also been made in the field of contrast enhanced fluoroscopy.

The aetiology, clinical presentation and outcomes of epiglottic calcifications are poorly understood. Radiographic evaluation together with exclusion of other causes is advised, after ruling out common causes of dysphagia.[4]

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AUTHORS DECLARATION

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Conflict of Interest

The authors declare that they have no conflict of interest.

Ethics approval

This study was approved by the University of the Western Cape, Faculty of Health Sciences Research Ethics Committee (Reference no.: BM21/03/06). All procedures followed the ethical standards of the Helsinki Declaration of 1975, as revised in 2008.

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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)

CPD questionnaire

Hard tissue characteristics of patients with bimaxillary protrusion

1. Select the CORRECT answer. Bimaxillary Protrusion (BP) is:

A. An under-reported form of malocclusion characterised by protrusive incisors with resultant protrusion of the lips.
B. As a result of the unaesthetic facial appearance brought about by this increased procumbency, many people seek orthodontic care in order to reduce this procumbency.
C. A review of the literature reveals that are no grey areas that exist in the diagnosis of bimaxillary protrusion.
D. It is clear whether the facial protrusion is solely due to incisor proclination, protrusion or both and whether there is also involvement of the dentoalveolar bases.

2. Which of the following statements is CORRECT. Regarding bimaxillary protrusion:

A. Culture, ethnicity, society as well as personal preferences do not play an important role in determining whether individuals will seek orthodontic treatment or not.
B. Interpretation of the many published studies performed on other population groups are applicable in a South African context.
C. There are no studies performed on the Black South African population to determine what is a pleasing and acceptable facial profile.
D. Bimaxillary protrusion is a common developmental condition amongst the South African Black population characterized by proclined incisors with resultant procumbency of the lips.

The marginal gap and internal fit of monolithic crowns milled with different luting spaces

3. Select the CORRECT option. It is generally accepted that the marginal gap of a full coverage crown should not exceed

A. 200 µm
B. 120 µm
C. 60 µm
D. 100 µm

4. Which statement is CORRECT. The internal fit of a full coverage crown

A. Should be as small as possible
B. Should be as large as possible to allow all the cement to escape
C. Is the misfit of the crown at the occlusal / incisal and axial surfaces
D. Is the distance from the margin of the crown to the margin of the preparation

5. Choose the CORRECT statement. It is preferable to measure the marginal gap:

A. At the buccal and lingual margins
B. At 4 points around the circumference
C. At the buccal or labial margin
D. At at least 20 points around the circumference

6. Select the CORRECT answer. Enamic is

A. A lithium disilicate ceramic
B. A zirconia reinforced lithium silicate
C. An interpenetrating network ceramic
D. A composite

Factors that affected the efficacy of non-surgical periodontal treatment carried out by postgraduate periodontology students

7. Choose the CORRECT answer. There are four phases associated with periodontal therapy, the consequence of this treatment occurs as follows:

A. The systemic phase, the initial non-surgical phase, the constructive surgical phase, and the supportive periodontal phase.
B. The initial non-surgical phase, the systemic phase, the constructive surgical phase, and the supportive periodontal phase.
C. The constructive surgical phase, the supportive periodontal phase, The initial non-surgical phase, and the systemic phase.
D. The systemic phase, the initial non-surgical phase, the supportive periodontal phase, and the constructive surgical phase

8. Select the CORRECT statement. According to the Consensus report of the 1st European workshop on periodontal education Periodontal treatment outcome is considered clinically successful when:

A. Absence of pocket depth (≥ 4mm) and bleeding on probing of ≤ 10%.
B. Absence of pocket depth (≥ 5mm) and bleeding on probing of ≤ 15%.
C. Absence of pocket depth (≥ 6mm) and bleeding on probing of ≤ 23%.
D. Absence of pocket depth (≥ 4mm) and bleeding on probing of ≤ 20%.

9. Which of the following is CORRECT. The periodontal parameters collected in this study to assess the success of treatment were:

A. Bleeding index (BI), Pocket Probing depth (PPD)
B. Pocket Probing depth (PPD), Plaque index (PI) and clinical attachment loss (CAL)
C. Bleeding index (BI), Pocket Probing depth (PPD), Plaque index (PI).
D. Pocket Probing depth (PPD), Plaque index (PI), bleeding index (BI) and clinical attachment loss (CAL)

10. Select the CORRECT option. The main reported influential factor that impacted the treatment outcome in this study was:

A. Patient compliance.
B. Presence of systemic disease.
C. Longer duration of treatment.
D. Patient's age.

Prevalence of oral impacts on daily performances among adolescents living with HIV at a tertiary paediatric hospital in Johannesburg, South Africa

11. Choose the INCORRECT answer: The participants in the study indicated that the most reported oral condition was:

A. Toothache
B. Attrition
C. Unwanted colour of teeth
D. Bleeding gums
E. None of the above

12. Which of the following statements regarding this study is CORRECT

A. Linear Gingival Erythema was the least common mucosal condition identified by the participants in the study
B. The Oral Impact on Daily Performance is insignificant as it has no impact on the gap between objective and subjective measures in oral health research
C. The demographic characteristics shows that most participants in the cohort were female.
D. Non adherence to HAART medication will not lead to a patient developing xerostomia in the oral cavity
E. All of the above are correct

13. Which option is CORRECT. How many parents of participants were unemployed?

A. 129
B. 55
C. 114
D. 60
E. 23

Radiology Corner: Calcification of the epiglottis

14. Choose the CORRECT answer. Calcified epiglottis as seen on a CBCT volume

A. may present as diffuse hyperdensities immediately posterior to the hyoid bone on axial and sagittal views.
B. may present as 'soap bubble' hyperdensities immediately posterior to the hyoid bone on axial and sagittal views.
C. may present as linear hyperdensities immediately posterior to the hyoid bone on axial and sagittal views.
D. may present as multi locular hyperdensities immediately posterior to the hyoid bone on axial and sagittal views.

15. Which of the following options is CORRECT. Extra osseous calcification is seen in patients with

A. primary hyperparathyroidism and lung diseases.
B. secondary hyperparathyroidism and cardiac diseases.
C. primary hyperparathyroidism and rheumatic diseases.
D. secondary hyperparathyroidism and renal diseases.

16. Select the CORRECT statement. The eppiglottis functions in

A. Preventing aspiration and assists in the coordination of swallowing
B. Preventing coughing and assists in the coordination of swallowing.
C. Preventing speaking and assists in the coordination of swallowing.
D. Preventing gagging and assists in the coordination of swallowing.

17. Which answer is CORRECT. Radiographic evaluation together with exclusion of other causes is advised

A. after ruling out common causes of hypoxia.
B. after ruling out common causes of dyspnoea.
C. after ruling out common causes of apnoea.
D. after ruling out common causes of dysphagia.

Evidence-based Dentistry: What's new for the clinician

18. According to the Barrak et al paper, which of the following measures best describes how long an implant lasts and is clinically acceptable:-

A. Survival
B. Success
C. Follow-up
D. Failure

19. Which of the following is NOT a technical complication that can lead to implant failure?-

A. fracturing of the implant itself;
B. fracture of veneering material;
C. abutment or screw loosening;
D. bleeding on probing

20. For the issue of Probing, which of the following statements is correct:-

A. Conventional probing with light force (0.25 N) can harm the peri-implant tissues
B. Probing is recommended at least once every five years
C. Only plastic probes can be used for probing around implants
D. Both metal and plastic probes can be used around implants

Ethics: Is it ethical to immobilize patient's jaws for weight loss? A deontological perspective

21. According to recent studies, jaw wiring for weight loss is the preffered treatment modality for the following reasons:

A. The procedure is reversable
B. The procedure is cost effective
C. The procedure does not require general anasthesia
D. All the answers are true
E. None of the above

22. Deontology is a moral theory that focuses primarily on:

A. The consequences of actions
B. The consequences of actions and the character of the healthcare professional
C. The duties of healthcare professionals
D. The character of the healthcare professional
E. The duties and the character of healthcare professionals

23. From a deontological perspective, dentists can wire jaws under the following circumstances:

A. The independent management of jaw fractures
B. The independent management of weight loss
C. In a multidisciplinary team for weight loss
D. In the independent management of jaw fractures and a multidisciplinary team for weight loss
E. All of the above are true

24. The scope of practice of dentists include:

A. The diagnosis of systemic disease
B. The diagnosis of the effects of systemic disease on oral health
C. Treatment of systemic disease
D. The diagnosis of oral diseases
E. b and d

25. In South Africa, the legal duties that dentists are expected to follow are imposed by:

A. The National Health Act
B. The Health Professions Act
C. Common Law
D. All the answers are true
E. None of the above

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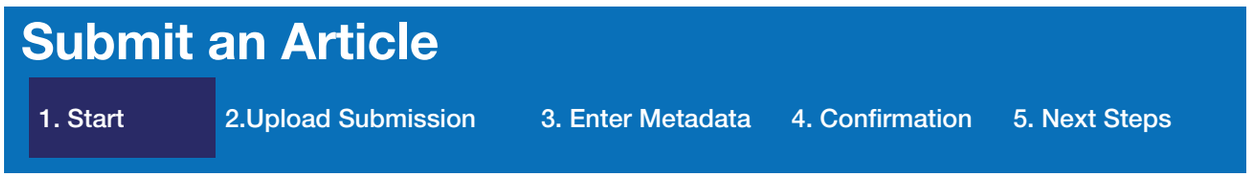

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