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THE SOUTH AFRICAN
DENTAL ASSOCIATION

The Fountain at the Vineyard Hotel in the Newlands

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Our Front Cover for this Issue...

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Identifying and managing patients' disease risk factors

SADJ October 2022, Vol. 77 No.9 p523

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

Assessing a patient's risk must be an integral part of any clinical examination, specifically when considering the long-term maintenance of the patient's oral health once correction and stability have been achieved. We attend to a patient's immediate need and the main complaint but discount the value of a thorough risk assessment as a long-term investment in a patient's oral and systemic well-being.

A risk factor can be a trait, a habit or action, or an exposure or contact with any entity, process or object that has an association with the development of a particular disease or condition. These may be environmental, behavioral, or biologic in nature and will increase the likelihood that an individual will develop a specific disease. It must be emphasized that risk factors are not always the same as aetiologic factors. Risk predictors or risk markers may be associated with a higher risk for disease development, but do not cause the disease. These should rather be viewed as circumstances, events or conditions that create a favorable scenario for the negative outcome to occur. Risk modification is possible within certain parameters and will serve to lower chances of disease initiation or progression. Examples of modifiable risk factors would include uncontrolled diabetes mellitus, smoking and alcohol use, poor plaque control. Non-modifiable risk factors include genetic factors and age and are often referred to as risk determinants or background characteristics.

Risk factors are commonly associated with several oral diseases and conditions. These include smoking and uncontrolled diabetes associated with periodontal disease, a sugary diet's association to the development of dental caries, and even tobacco and alcohol use with the development of oral squamous cell carcinoma to mention only a few. Whether these risk factors are unique to a particular individual, or commonly encountered in the environment, there is an obligation on the oral healthcare professional to identify these and address these in the best possible way available. This will facilitate the delivery of an optimal treatment plan with accurate prognostication.

It is essential to consider all patient risk factors as a component of the rationale and the scientific basis for developing a sound, evidence-based strategy for controlling oral diseases, both on the individual and community levels. This must include the removal of all risk factors where appropriate, and when not possible, to include behavioral modification where required as well

as interdisciplinary consultation and management for non-modifiable risk factors. The complete and comprehensive patient assessment should not be limited to a brief medical history and extra- and intra-oral examination. Rather, a few more moments should be spared to gather additional data on the patient's background, stressors, socio-economic status and position, familial characteristics to modify treatment plans and prognoses appropriately.

The outcome sought is to lower the disease burden and morbidity rates within the individual as well as the practice and the community it serves. Benefits of the implementation and application of risk assessment tools are apparent to practitioners as enrichment in the identification of the most relevant risk factors, efficiency of communication, as well as patients' education, satisfaction, and treatment acceptance. Similarly, patients may perceive this as improved awareness of the nature and severity of their disease and may advance their intentions to adhere to any instructions received from the practitioner. Once this enhance position of dealing with the disease burden is achieved, the maintenance of all therapeutic approaches should be easier.

CPD Compliance

SADJ October 2022, Vol. 77 No. 9 p524

Dr Nthabiseng Metsing, Head: Professional Development, SADA

Take a moment to consider where you were professionally some years back or what your profession looked like when you first entered the workforce. Regardless of the time period that has lapsed or the industry in which you operate, chances are, you've experienced significant change as a professional, to how you work, within workplace cultures, systems and with the technology you use, to name a few.

Change as we know is constant. In the rapidly-evolving workplace, professional growth is imperative not only to keep progressing with career ambitions, but also to sustain present-day skillset relevancy. Continuing Professional Development programmes are among the best options, in this regard, to stay ahead of the curve and achieve greater success in one's professional journey.

As we near the end of the year SADA would like to remind members about their CPD requirement for the year, there is still time if you are still short of points. The maintenance of Continuing Professional Development (CPD) is one of the requirements of HPCSA registration. Practitioners are required to accumulate Continuing Education Units (CEUs) per twelve-month period, including ethics, human rights, and medical law.

Each CEU will be valid for 24 months from the date on which the activity took place (or ended, in the event of post-graduate studies) after which it will lapse. This means that practitioners should aim to accumulate a balance of 60 CEUs by the end of their second year of practise, and thereafter top-up the balance through additional CPD as each 24 –month validity period expires.

Previously the HPCSA conducted mandatory random audits to ensure compliancy. Where once a practitioner's name was selected, they were required to submit a CPD portfolio to Council within 21 days. Non-compliant practitioners were given six months to comply. After the period of 6 months a practitioner would again be audited and if there was still non-compliance, the Professional Board considered appropriate action.
Practitioners were only required to submit their CPD portfolios if their names were drawn from a random sample audit and when requested to submit their completed form CPD 1 IAR with accompanying proof of CPD activities undertaken.

This is no longer a requirement and as mentioned before in the SADA previous communiques which indicated that the HPCSA no longer accepted CPD certificates by e-mail as they have migrated to a new CPD system/online portal.

As a result of the many enquiries from members SADA wishes to highlight the new process again which states that:

- CPD certificates are no longer mandatory
- Bulk uploading of CPD information will be done directly by the service provider (SP) straight to the HPCSA portal, instead of individual upload.
- The Accreditors and Accredited Service Providers (ASP) will have direct integration with HPCSA, thereby eliminating the need for certificate uploading by practitioners.
- The ASP submission of information to their Accreditors can be made directly to the HPCSA before CPD status of delegates can be updated.
- The Accreditors' quality assurance functions, such as monitoring providers' compliance with the accreditation guidelines, will also be performed online thereby reducing administrative burden to the Accreditors.
- Accreditors will have access to instant reports of their service providers on demand.
- Practitioners will also be able to view their profile and monitor their compliance on the HPCSA's new portal. On https://practitionerssso.hpcsa.co.za/

The association wishes to encourage members to comply with the HPCSA regulations of the CPD requirements.

CPD questionnaire on page 576

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

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Prevalence of oral mucosal and periodontal disease amongst patients receiving dialysis

SADJ October 2022, Vol. 77 No. 9 P525-p534

L Kotze[1], J Fourie [2]

ABSTRACT

Introduction

End-stage renal disease (ESRD) requires renal replacement therapy (RRT), namely a renal transplant or renal dialysis or both. Dialysis corrects the electrolyte imbalance and reduces circulating urea and creatinine levels. ESRD patients may present with oral complications and disease due to impaired renal functions, associated comorbidities, or the pharmacological management thereof.

Aims and Objectives

To determine the prevalence of periodontal- and oral mucosal disease in ESRD patients undergoing dialysis. Recommendations will be made regarding dental treatment needs and dental management.

Design

Cross-sectional study.

Methods

Fifty-three ESRD patients were evaluated for mucosal lesions and periodontal disease. Patient's age, race, gender, comorbidities, dialysis duration and medication were recorded. Treatment urgency was determined, and patients referred accordingly for appropriate dental treatment.

Results

Mean age of patients was 42,9 ±10,4 years with a median time on dialysis of 30 months. Majority of patients were hypertensive (94.34%). No oral mucosal lesions was found. PSR score of 3 was mostly found (36.58%). Sixty-two percent of patients had a moderate treatment urgency.

Conclusion

A relationship between chronic kidney disease and periodontitis exists. ESRD patients should thus be enrolled into a periodontal screening and treatment program and all dental treatment should be completed prior to kidney transplantation.

List of Abbreviations

CKD	Chronic kidney disease
GFR	Glomerular filtration rate
RRT	Renal replacement therapy
ESRD	End stage renal disease
HD	Haemodialysis
PSR	Periodontal screening and recording index
WHO	World Health Organization
PD	Peritoneal dialysis
SBAH	Steve Biko Academic Hospital
UPOHC	University of Pretoria Oral Health Center
BOP	Bleeding on probing
PPD	Periodontal probing depth
OHI	Oral hygiene instructions
OLDR	Oral lichenoid drug reactions
CRP	C-reactive protein

INTRODUCTION

Chronic kidney disease (CKD) can be defined as potentially progressive alterations in the kidneys' physiology and histology, which may result in renal impairment.[1] These structural and functional changes in the kidneys should be present for 3 months or more to be classified as chronic. Individuals at risk for renal damage and those with decreased glomerular filtration rate (GFR) are deemed to have CKD.[1] The two main causes of CKD are diabetes mellitus and hypertension, which negatively impact patients' cardiovascular system and renal structure before and after renal transplantation. Other causes of CKD are glomerulonephritis, chronic pyelonephritic urologic disorders and autoimmune diseases.[2]

The incidence of CKD in patients is on the rise worldwide, and patients over the age of 60 with uncontrolled hypertension, diabetes and cardiovascular disease are particularly at risk.[3,4] These patients are burdened with multiple health problems of which oral diseases go undiagnosed.[3] The dental practitioner will inevitably manage patients suffering from renal failure and should be aware of some oral diseases (mucosal lesions, periodontal disease, dental decay) that may be more prevalent in this group of patients.

The kidneys have multiple essential functions: 1) metabolic waste product excretion; 2) regulation of electrolytes; 3) acid-base homeostasis; and 4) endocrine

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1.	Leande Kotze:	60%
2.	Jeanine Fourie:	40%

function (particularly renin-angiotensin system, vitamin D metabolism and erythropoietin production). These renal functions are involved in various physiologic pathways that maintain health.[3,4]

As kidney disease progresses, the nephrons are gradually destroyed, and the GFR deteriorates. The GFR is used to stage these patients from 0 – V. Their corresponding treatment needs are categorised according to these categories.[2] The final stages of CKD requires renal replacement therapy (RRT), where the patient requires a renal transplant or renal dialysis or both.[2]

Dialysis is a life-saving intervention to prolong a patient's life[2,5] with or without eventual renal transplantation.[6] Management of end-stage renal disease (ESRD) aims to correct the electrolyte imbalance and reduce the level of urea and creatinine in the circulation.[2,5-7] Patients with ESRD require haemodialysis (HD) for three to five hours, two to three days per week. [2,6] HD replaces the lost filtration function of the defective nephrons to reduce retained salt, water and metabolic waste products that are potentially fatal.[8]

While HD may prolong the patient's life expectancy, uraemia to some degree persists, resulting in various systemic complications.[2] Peritoneal dialysis (PD) employs the patient's peritoneum as a filtration device instead of a machine, giving the patient more daily independence.[2,7] Haemodialysis patients require anticoagulant treatment with local or systemic heparin to facilitate filtration. Haemodialysis patients are only heparinised on the day of dialysis, and PD patients are on continuous anticoagulant treatment; this adds to the haemorrhagic risk.[2]

As mentioned previously, impaired metabolic and endocrine kidney function results in various systemic complications. End-stage renal disease is characterised by decreased endocrine and metabolic kidney functions, leading to retention and accumulation of toxic metabolites that can't be eliminated, resulting in uraemia. Patients may develop anaemia due to decreased erythropoietin, while reduced erythropoietin, combined with uraemia, impairs platelet function, resulting in a haemorrhagic tendency. Immunodeficiency due to uraemia and diabetes mellitus, which is often a comorbidity as it can also be a cause of CKD, increases ESRD patients' susceptibility to infections.[2, 7, 9]

Finally, it is important to note that many drugs are excreted to some extent by the kidneys. Drug distribution, metabolism, bioavailability, and elimination are impaired when renal excretion is reduced, necessitating dose adjustments.[2]

Patients suffering from ESRD may present with oral complications and disease due to impaired renal functions and the associated comorbidities or the medical management thereof.[4,6,7] Mucosal, glandular, gingival, periodontal, bony and dental hard tissues are affected collectively (Table I).[4] This should be kept in mind when examining these patients, and they should be managed accordingly. End-stage renal disease patients should be screened for periodontal disease and treated accordingly.[4,9] The Periodontal Screening and Recording index (PSR) is supported by the World Health Organization (WHO) to reliably indicate the treatment needs of patients suffering from periodontal disease.[10,11]

Table I: Oral and Periodontal manifestations in ESRD [adpated from Constantinides et al. (2018)][2]

Oral and Periodontal manifestations in ESRD	
Mucosal and glandular manifestations	Mucosal pallor (anaemia) Ecchymoses, petechiae and heamorrhage Xerostomia Uremic fetor (halitosis) Burning sensation Uremic stomatitis Angular cheilitis Candidiasis Oral lichenoid drug reactions
Periodontal manifestations	Calculus deposition Gingivitis Periodontitis Gingival enlargement (drug -induced)
Bone manifestations	Renal osteodystrophy Tooth mobility Malocclusion Pulp stones Enamel hypoplasia Bine demineralization Giant cell lesions Spontaneous jaw fracture Abnormal healing after tooth extraction
Dental tissue manifestations	Lower caries rate Dental erosion Enamel hypoplasia and delayed eruption in children Pulp narrowing and calcification

This study aims to determine the prevalence of periodontal- and oral mucosal disease in patients with ESRD undergoing dialysis. Accordingly, recommendations will be made regarding the dental treatment needs and dental management of patients with ESRD.

MATERIAL AND METHODS

This was a cross-sectional study done among ESRD patients receiving dialysis at the Department of Nephrology, Steve Biko Academic Hospital (SBAH). Dental screenings were conducted to prepare patients for receiving a kidney transplant from October 2019 to February 2020. Consent to access data from the patient files were obtained from the CEO of the University of Pretoria Oral Health Center (UPOHC) and SBAH. The project was submitted to and approved by the Health Research and Ethics committee (Ethics reference number 850/2019).

Participants:

The clinic serves 130 ESRD patients, 50 receiving HD and 80 receiving PD. After obtaining consent, haemodialysis patients included in the study were seen at the dialysis clinic, while PD patients were referred to the Periodontics and Oral Medicine department at the UPOHC.

Inclusion and exclusion criteria:

All renal dialysis patients treated at Steve Biko Nephrology clinic, who consented to have dental screenings done,

were included in the study. While patients who did not give consent, were deemed unfit for dental screening due to oxygen requirements or whose full medical records were not accessible were excluded from the study. Patients with medical conditions like cardiac lesions that may predispose them to bacterial endocarditis were also excluded when periodontal probing is done.

Clinical examination and indices:

The dental screening of all dialysis patients was carried out by one dental practitioner.

Examinations in the dialysis clinic were performed while the patients received HD in hospital beds. The primary dental practitioner conducted the visual examination with a dental mirror, UNC-15 periodontal probe, and handheld flashlight held by the second dental practitioner. In contrast, those examinations conducted at the UPOHC were performed under standard dental conditions in a dental chair with an attached light source with a dental mirror and UNC-15 periodontal probe.

All findings were documented in standardised examination forms drawn up specifically for the study.

The following clinical examinations were performed:
Extra-oral examination by visual examination and palpation noting for:

- Swelling.
- Lymph node enlargement and/ or tenderness.
- Temporomandibular joint and facial muscle abnormalities.
- Skin and lip abnormalities.

Intra-oral examination by visual examination and periodontal probing:

- PSR: This diagnostic index was proposed by the American Academy of Periodontology in 1991 and is simple, fast, and preferred by patients.[12] This evaluates gingival bleeding, calculus accumulation and probing depth. The findings were collected and scored from code 0 to 4 by dividing the oral cavity into six sextants (Figure 1):
  0: Healthy
  1: Bleeding on probing (BOP)
  2: BOP and calculus
  3: Periodontal probing depth (PPD) of more than 3mm, but equal to 5mm
  4: PPD of more than 5mm. Only the highest score per sextant was recorded.
- Noting for caries by visual examination and probing.
- Noting oral mucosal lesions.
- Salivary gland function was measured by milking the salivary glands and the sliding mirror test.

Treatment needs and urgency

The periodontal findings were placed into the following periodontal treatment needs categories according to the PSR index scores:

- Preventative treatment only (PSR 0)
- Oral hygiene instructions (OHI), plaque and debris removal (PSR 1).
- OHI, Subgingival plaque and calculus removal (PSR 2)
- As in 2 with complete periodontal examination and radiographs, possible referral to a periodontist (PSR 3)
- As in 3 + more extensive treatment, possibly surgery, refer to a specialist (PSR 4)

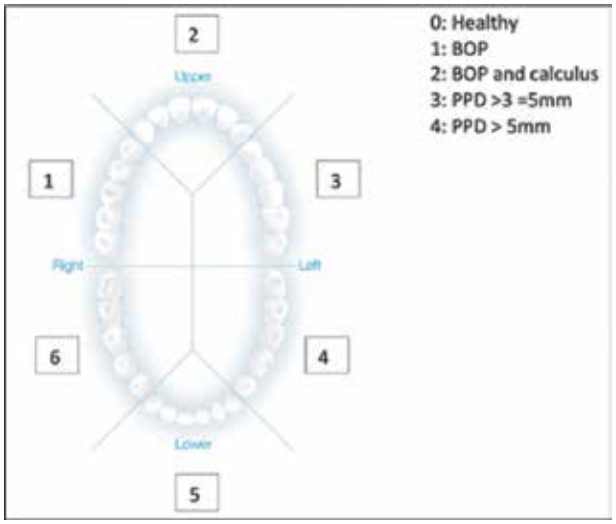

Figure 1: PSR illustration of sextants & description of periodontal probing measurements. (Image courtesy of The Probe: https://the-probe.co.uk/courses/gsk-june-2020-the-bewe-gdc-development-outcome-c/)

Feedback of treatment needs: Feedback regarding the results of the patient's dental screening and treatment was provided to the treating physician in the Nephrology department, as this may influence the treatment and eligibility of the patient for a renal transplant.

A note whether teeth were carious or not was made and whether restorative work, endodontic treatment or extraction is needed. The patients were accordingly referred to the respective clinical departments at the UPOHC.

The treatment urgency of each patient was subjectively determined according to the examiners experience and expertise and characterised into low, medium, and high according to the risk of systemic infection.

Data retrieved from patient records:

Each patient was given a number, and all data assigned to this number was captured on an Excel spreadsheet. The following information was noted: age, race, gender, comorbidities, duration of dialysis and list of drugs.

Statistical analysis:

Initial data analysis included mean, median, standard deviation, and range for continuous variables. Frequencies and proportions and 95% confidence intervals was given for categorical variables.

RESULTS

Epidemiology

A total of 53 patients, 39 men and 14 women, with a mean age of 42,9 ±10,4 (23 – 64) years, were included in the study. Forty three (81.1%) of the patients were Black, 2 (3.8%) Colored, and 8 (15.1%) Caucasian. One patient was excluded due to oxygen requirements and being in isolation.

Medical history & medications

The mean dialysis treatment time was 34.2 ± 16.8 months. Most patients were heparinized (86,8%) on the day of treatment. The majority (n=44, 83.02%) of patients were screened at SBAH, receiving dialysis in hospital, and

the rest (n=9, 16.98%) were screened at the UPOHC, reflecting the sample population of HD and PD patients, respectively. The most common comorbidity was hypertension (94.34%), followed by HIV (13.21%) and diabetes mellitus (5.66%). All patients with diabetes had hypertension as well. Other comorbidities documented were anaemia, hypercholesterolaemia, bone mineral disease, cardiac failure, gastric ulceration, pancreatitis, multiple myeloma, epilepsy and tuberculosis (Figure 2).

Given the prevalence of hypertension, diabetes mellitus and HIV among this population, the most commonly prescribed drugs were antihypertensives, antiretroviral drugs and antidiabetic agents.

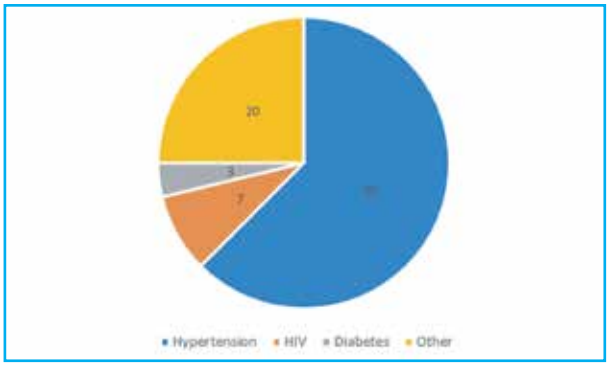

Figure 2: Distribution and prevalence of comorbidities in patients with CKD.

Figure 3 illustrates the percentage of the most common antihypertensive drugs used in this population of CKD patients. The colour index represents the drug class distribution illustrated in Figure 4. Amlodipine (70%) and hydralazine (41%) were the most commonly used vasodilator drugs. Amlodipine was the most common drug used in this study group. Furosemide (Lasix) (51%) was the most popular diuretic and second most common drug prescribed. Doxazosin (Cardura) (39%) and Carvedilol (Carloc) (39%) were the two adrenergic blockers used most often. Figure 4 shows the antihypertensive drug class distribution, with vasodilators (51%) being the most frequently used drug class in this study group.

No abnormal mucosal lesions were detected, and normal variations such as Fordyce granules and leukoedema were not recorded. The prevalence of the different PSR

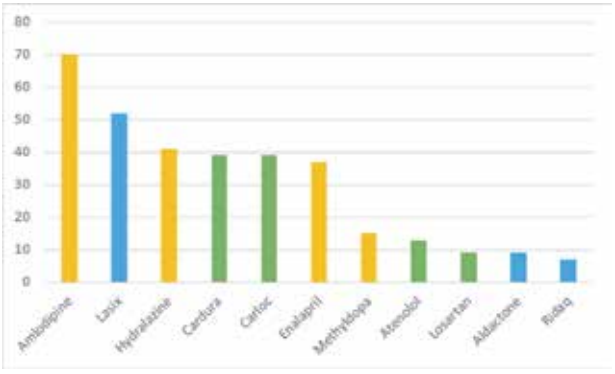

Figure 3: Percentage of most common antihypertensive drugs used in this population of CKD patients.

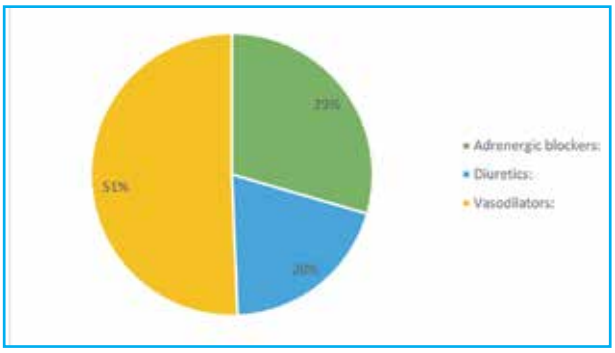

Figure 4: Antihypertensive drug class distribution. Mucosal and Periodontal involvement

scores were as follows: 0 – 19.46%; 1 – 6.38%; 2 – 23.83%; 3 – 36.58% and 4 – 13,76% (Figure 5).

The PSR score of 3 was encountered most (36.58%), meaning that the patients had PPD of 4-5mm, which according to the Van der Velden periodontal classification,[13] could be classified as mild periodontitis, and according to

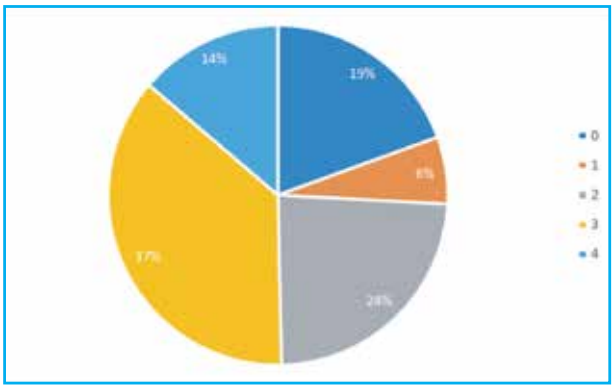

Figure 5: Prevalence of PSR scores

the World Workshop 2017 classification,[14] as Stage I and II periodontitis. The posterior sextants were mostly affected by mild periodontal disease with probing depths of ≤ 5mm. The anterior mandible (sextant 5) harboured most calculus BOP, and the anterior maxilla (sextant 2) was healthy in most cases.

Periodontal treatment needs according to the periodontal findings are illustrated in Figure 6. Most patients (81%) required OHI, as all patients with PSR scores from 1-4 had suboptimal oral hygiene. Fifty-one percent of the patients required nonsurgical periodontal treatment and 30% prophylactic treatment only.

The frequency of dental treatment that dialysis patients with CKD required was periodontal debridement (52.3%), followed by restorations (32.1%) and extractions (30.2%), as illustrated by Figure 7.

Sixty-two percent of patients had a moderate urgency for treatment (Figure 8), meaning a moderate risk for systemic infection.

DISCUSSION

Patient population

Fifty-three patients were included in the study, with most patients (83.02%) receiving HD. Unfortunately, many PD

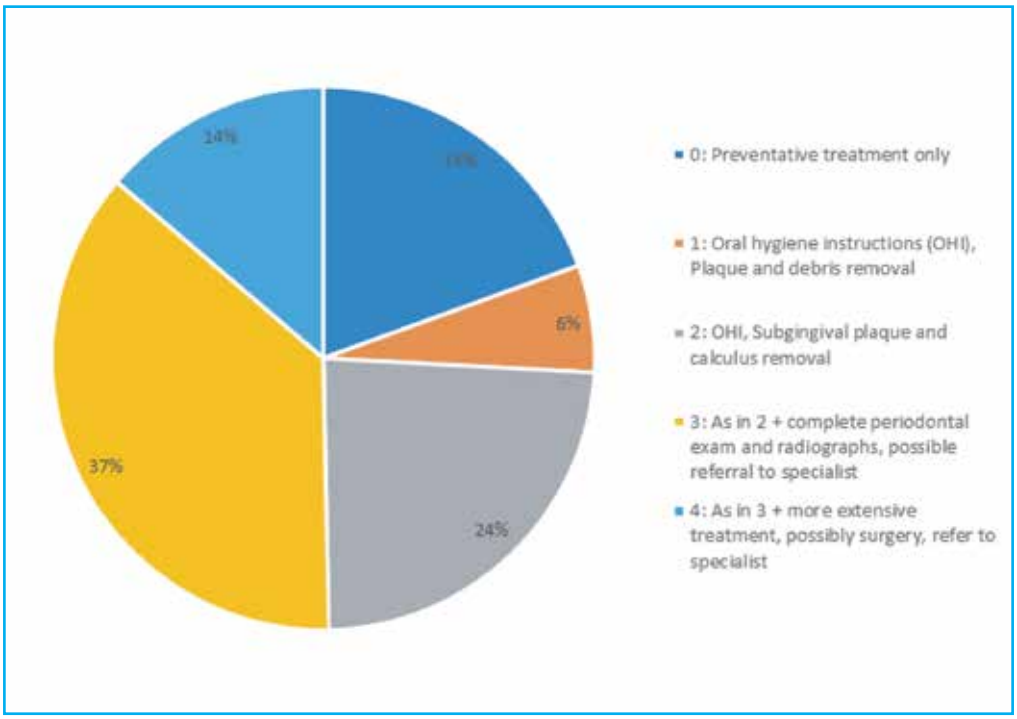

Figure 6: Proportional distribution of periodontal treatment needs according to PSR results

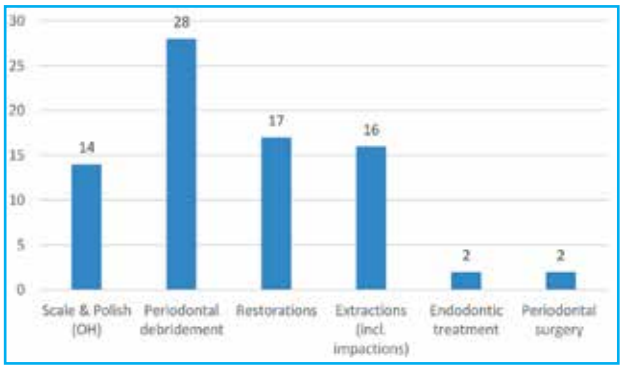

Figure 7: Number of patients needing respective dental treatment.

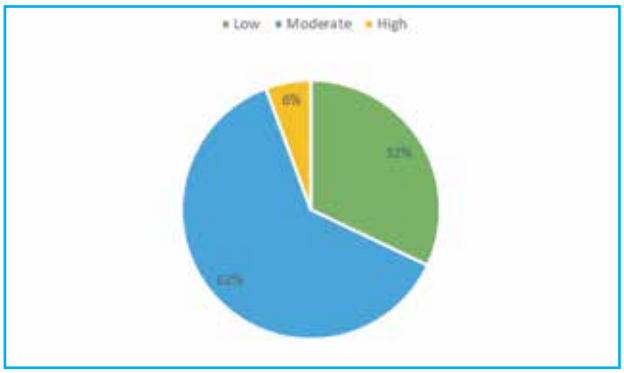

Figure 8: Treatment urgency

patients did not comply with the referral to the UPOHC. We speculate that this may be due to a lack of patient education and understanding of the benefit or purpose of the referral. Time and finances may also play a role as we are dealing with an underprivileged population in this setting. The onset of the Covid-19 pandemic and subsequent restrictions halted further screening at SBAH to reduce any infectious risk to this vulnerable population. One patient was excluded due to oxygen requirements and being in isolation.

Oral complications and disease

Various oral mucosal lesions have been reported in ESRD patients,[15,16] either due to the disease or the treatment thereof. Dialysis has a significant impact on patients' quality of life, which might mean that oral hygiene is not a priority.[17-19] This could increase their risk of periodontal disease and caries.[2,4,17,18] Oral complications and diseases are due to the impairment of various renal functions, associated comorbidities like diabetes mellitus and hypertension and the pharmacological management thereof.[6,7,15] Almost all patients are on antihypertensive medication which is known to be associated with lichenoid lesions, gingival enlargement, and xerostomia.[15,16]

While comorbidities such as diabetes mellitus and the accompanying immune suppression, may also be responsible for some oral lesions. The presence thereof may signify worsening blood glucose control and immunosuppression.[4] A common consequence of immune suppression in ESRD patients and other populations is oral candidiasis,[5,17,20] yet, none of our patients displayed any clinical signs of candida infection. Three percent of the patients screened in this study had diabetes, and all of these had periodontal disease. A bidirectional relationship between diabetes mellitus and periodontitis exists,[21] and ESRD and periodontitis.[22] Both diabetes and periodontitis have been implicated in an increased risk of atherosclerotic disease in ESRD patients.[23,24] A unique phenomenon in ESRD patients, namely uremic stomatitis, was also not seen in this population.[2,4, 25,26]

Uraemic stomatitis

Uremic stomatitis is a rare and infrequently documented disorder associated with longstanding elevated blood urea levels (above 300mg/mL) in patients with CKD.[25] It is characterised by white adherent plaques found mainly on the tongue's dorsal and/or ventral surface, the floor of the mouth, and buccal mucosa with accompanying burning pain and dysgeusia. In addition, an odour of ammonia may be detected in the patient's breath.[25,26] Raised circulating ammonia levels may cause a chemical burn, but bacterial ureases may also alter salivary urea forming ammonia. Reducing the circulating ammonia levels through dialysis and the use of an antimicrobial mouthwash will resolve these lesions.[25] This is likely why we did not find any sign of uraemic stomatitis in this study population.

Pharmacologic agents employed in the management of ESRD and associated comorbidities, and their effects

Pharmacologic treatment of hypertension in ESRD usually consist of combination drug therapy that directly lowers blood pressure and has additional renoprotective and cardioprotective effects.[27]

According to the South African hypertension practice guideline (2014), the initial first-line therapy is a diuretic, angiotensin-converting enzyme (ACE) inhibitor or angiotensin II receptor blocker (ARB) and/or calcium channel blocker (CCB) as mono – or combination therapy. Fixed drug combinations are preferred as patient compliance, and blood pressure control is better.[28] ACE inhibitors and ARB are both renoprotective and cardioprotective, therefore invaluable in patients with CKD. Diuretics reduce volume overload and is used in combination therapy in CKD to offer antihypertensive and cardioprotective effects. CCB is useful in managing CKD and is often used as first-line therapy alone or in combination with ACE inhibitors. Beta-blockers have well established cardioprotective effects and are also renoprotective. Alpha-blockers are frequently used as part of combination therapy.[27]

In this study, most subjects were on combination antihypertensive therapy, with CCB and diuretics being the most commonly used agents and amlodipine the most commonly used CCB. CCB is frequently associated with drug-induced gingival enlargement, largely determined by drug variables, plaque-induced gingival inflammation, and genetics, which influence collagen matrix metabolism by altering the release of matrix metalloproteinases and inhibitors of matrix metalloproteinases.

The inhibition of calcium uptake by gingival fibroblasts is directly proportionate to the inhibition of fibroblast proliferation, meaning that collagen production (gingival tissue bulk) increases, and breakdown is diminished, resulting in enlarged gingival tissues.[29] In this study, we did not find any gingival enlargement that may be drug-associated. This correlates with the studies by Ellis and co-workers, who found that the prevalence of CCB induced gingival enlargement is lower than previously reported. They demonstrated significant differences between CCB, with amlodipine use resulting in gingival overgrowth only 1.7% of the time, compared to 6.3% by nifedipine. [30-32] Both drugs are dihydropyridines, but amlodipine is more polar, requiring active transport mechanisms to enter the fibroblast, while nifedipine is extremely lipophilic and readily enters into the fibroblast cytoplasm.[32] The pharmacokinetic profiles of amlodipine and nifedipine also differ. Amlodipine has a much longer half-life (T1/2 = 34 hours) than nifedipine (T1/2 = 7.5 hours) and high volume of distribution, 21 litres/kg, and 0.78 l/kg, respectively. This means that most of the amlodipine will be inactive (tissue bound) at any given moment instead of circulating freely in the blood.[33]

It has also been hypothesised that drug-induced gingival changes occur above a certain plasma threshold. If this is the case, then amlodipine may rarely reach such a threshold level due to its long half-life and steady plasma state, whereas nifedipine frequently displays marked peak plasma levels.[32] Plaque induced gingival inflammation may exacerbate drug-induced gingival enlargement.[32] In our study, most of the patients suffered from periodontal disease; thus, gingival inflammation is present; however, none of the individuals displayed gingival enlargement.

Antihypertensive medications and the combined use of multiple drugs may cause hyposalivation and xerostomia, making it difficult to establish the exact role of the various antihypertensive drugs in altering salivary flow.[34] Diuretics increase urinary output, thereby reducing circulatory fluid volume and renal and cardiac workload and salivary flow. In 2021, Ramírez and colleagues demonstrated that diuretics are almost exclusively responsible for hyposalivation among antihypertensive drugs. They reported that patients who took ARB's, like losartan (which was also used by many in our current study), suffered less from xerostomia. This drug selectively binds angiotensin II, meaning that systemic collateral effects from the metabolism of other substances do not take effect, subsequently with less hyposalivation and xerostomia.[35] The patients in our study did not suffer from hyposalivation as measured by adequate pooling of saliva, milking saliva from the major salivary glands, and freedom of movement of the dental mirror across the mucosa. This could most likely be due to the combination of drugs, where the agents that act on the renin-angiotensin system counter the unwanted xerostomic effects of the diuretics.

Besides xerostomia, antihypertensive medications have been implicated in many other oral adverse drug events. Oral lichenoid drug reactions (OLDR) may be caused by certain medications and resemble idiopathic lichen planus. The two main drug classes associated with OLDR are nonsteroidal anti-inflammatory drugs and of more significance in this study, antihypertensive medications like beta-blockers, ACE inhibitors and particularly, hydrochlorothiazide diuretics.[36]

The hypothesised pathogenesis for this phenomenon is that susceptible individuals have cytochrome P450 enzyme polymorphisms resulting in insufficient medication metabolism and increased plasma concentration. However, a study in 2010 by Kragelund and co-workers failed to illustrate this possibility due

to the anecdotal nature of OLDR, which is mostly characterised by clinical observation; however, their, as well as our study, was limited by a small population.[37] Despite multiple studies reporting on lichenoid lesions associated with antihypertensive medications, the present study did not report any OLDR.

Periodontal health status

There is conflicting evidence on the periodontal health status in patients with CKD. Multiple studies report that periodontal disease is more prevalent in patients undergoing HD[38-40], while others find no significant increase in periodontal disease in patients with CKD.[17,41,42]

It is argued that an increased uremic state results in immunosuppression; however, patients may still be able to launch an appropriate response against bacterial pathogens.[7,17,41,42] Unfortunately, this population may be overburdened with microbial plaque due to suboptimal oral hygiene [7,17,19,41,42] thereby placing them at increased risk of periodontal destruction.

The current study population reflects the general population, which also displayed suboptimal oral hygiene, with 81% requiring professional dental prophylaxis. However, the mild periodontal destruction measured did not correlate with the increased amount of plaque, calculus, and gingival inflammation. Bayraktar and colleagues in 2007 noted that heavy calculus deposition in the population may be due to an altered saliva phosphorous-calcium balance in CKD patients, which mimics serum changes.[43]

In the present study population with a median age of 42.9 years, 52.3% of patients suffered from periodontitis. This corresponds to the 51.6% prevalence among South African adults of 35-44 years of age that was recently reported.[44]

Therefore, our study population with ESRD does not have a higher prevalence of periodontal disease than the general South African population. However, in 2004 Duran and Edimir noted that periodontal breakdown increases with time on dialysis. This can only be elaborated on if our study is continued in the future, and we use the current measurements as baseline findings.

Periodontitis and ESRD

It is encouraging to see the low prevalence of periodontal disease in this population because a known relationship between periodontal disease and cardiovascular disease exists.[24] Periodontal disease is known to cause an increase in serum inflammatory markers like C-reactive protein (CRP) and other acute-phase proteins. Periodontitis is also associated with a decrease in high-density lipoprotein and an increase in low-density lipoprotein and blood glucose.[45] It is evident that periodontal disease increases atherosclerosis.[24,46] The release of pro-inflammatory cytokines associated with periodontal disease results in a local and systemic inflammatory response that may result in vascular endothelial damage and promote atherosclerosis formation.[47] Periodontal pathogens have been found in atherosclerotic plaques which may increase the risk of atheroma's forming in patients with CKD.[48,49]

A strong association between atherosclerotic complications and increased systemic inflammatory burden exists. The major cause of death in patients with ESRD on HD is atherosclerotic complications like acute myocardial infarction, cardiac arrest, cardiac arrhythmia, and cerebral vascular disease, followed by infectious complications.[39] CRP, an acute-phase protein and marker of inflammation, is a major predictor of cardiac and other mortality in the broader, specifically the ESRD population.[50] CRP is implicated in the pathogenesis of atherosclerotic complications by binding to receptors on the cell membranes of macrophages, monocytes and neutrophils, consequently activating the complement cascade. Thus, CRP amplifies inflammatory reactions resulting in atherosclerotic complications.[39] Significantly, the mortality of HD patients can be correlated with the severity of periodontitis[51,] but fortunately, successful periodontal treatment can reduce serum CRP levels in periodontitis patients[52,53], thereby mitigating systemic risks. It is thus evident that there is a bi-directional correlation between periodontitis and CKD.[54]

Management

General routine dental care can safely be done in patients with ESRD, though one should be mindful of drug sensitivities and immunosuppression.[2] The coagulation status should be assessed before any invasive dental treatment that may result in bleeding due to the altered uraemic state and heparin treatment in dialysis patients. A dose reduction of renally excreted drugs may be necessary due to diminished renal metabolism and secretion.[38] Alteration to any drug dose according to renal function can be found in the Drug Prescribing in Renal Failure, Dosing Guidelines for Adults.[55] Orofacial infections like dental abscesses, periodontal infection and maxillary sinus infection should be aggressively treated, keeping the antibiotic dose adjustment in mind, to prevent future graft rejection and bacteraemia. The vitals of ESRD patients with significant hypertension should be monitored throughout treatment to identify changes in blood pressure due to stress or the administration of local anaesthetics containing adrenaline. The blood pressure cuff should not be placed on the arm where the shunt is located [2,38]

Periodontal disease is an important cause of chronic inflammation in CKD patients and even more so in patients with diabetes as a comorbidity.[56] Chronic systemic inflammation is a major risk factor for atherosclerotic disease in this particular population.[57] It is therefore critical that CKD patients are educated about their oral health and treated accordingly. A study done in 2018 by Tasdemir and co-workers demonstrated that nonsurgical periodontal debridement effectively reduces the inflammatory markers of patients receiving dialysis treatment.[56] Patients should be enrolled in an active preventive treatment plan and all invasive dental procedures completed before transplant surgery.[17,58] All parties involved should be knowledgeable about treatment priorities, operative concerns and precautions

that need to be taken in ESRD patients with or without dialysis.[17]

CONCLUSION

The results of our study emphasise the importance of periodontal disease assessment given the significant impact that this disease may have on the mortality of patients with ESRD. Both patients awaiting renal transplants and nephrology clinics should be made aware of the importance of dental screening and treatment to ensure that patients are infection-free while awaiting renal transplantation. Nephrology clinics should implement a dental care protocol to manage all CKD and ESRD patients. We recommend that dental practitioners treating CKD patients should perform a PSR and subsequently a comprehensive periodontal examination and nonsurgical periodontal debridement where indicated. Maintenance of the patient's periodontal condition is essential to minimise additional cardiovascular disease risk and ensure the success of the transplanted kidney.

Finally, it is important to note the sample size of this study was small, and a larger population could have yielded different results. Periodontitis is a progressive disease that worsens over time if not managed. It would be beneficial to continue follow up of the patients in this study to monitor the effects of treatment and non-treatment. Furthermore, the PSR is only a very crude measurement of a patient's periodontal condition, yet it would be interesting to correlate the CRP levels with the PSR score, and among patients who require periodontal treatment, measure the effect of treatment on the CRP levels. Candida can be present subclinically, it would have been more informative to do a cytological smear to detect this.

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Self-reported substance use, in dental and oral hygiene students at a university in South Africa

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ABSTRACT

Background

A recent study amongst South African dental students found that a number of them had perceived moderate to severe stress and as a result, some have resorted to stimulant drugs.

Aim

The aim of the study was to assess substance use by dental and oral hygiene students at a university in South Africa.

Design

A cross-sectional design was used and all dental and oral hygiene students registered in 2019 at a university in South Africa were asked to participate.

Materials and Methods

A pretested, validated self-administered questionnaire was used to achieve the aim. The objectives were to identify which substances were used, where they were obtained, frequency and reasons for use, as well as the self-perceived benefits and side effects experienced. Data was analysed using SPSS version 27. The data was confidential and anonymity was ensured.

Results

A total of 303 (88%) agreed to participate with ages from 17 to 36 years and a mean of 22.3 years. Over two thirds 206 (67.9%) used substances. Almost half of the group (44.6%) took one product, 16.5% took two, and 7% consumed between 3 and 5. The sources of substances ranged from peers, friends, acquaintances and pharmacies. Nearly twenty percent of the students used caffeine products, energy drinks, and methylphenidate. Almost 10% used anti-anxiety pills and anti-depressants whilst just above 11% used natural boosters and multivitamins. More than half of the students used the substances to stay awake and improve marks and 45(22%) of the users struggled to stop.

Conclusions

Over two thirds of students used substances, with almost half using one substance. There were multiple sources of substances. More than half of the students used them to stay awake and improve marks.

Key words: Stimulant drugs, methylphenidate, stress, academic performance.

BACKGROUND AND LITERATURE REVIEW

Dental students worldwide are experiencing increased pressure to cope with both their academic requirements and passing the theoretical component of their course, as well as the long clinical hours needed to achieve practical competence. Other stressors originate from insecurities felt when treating patients, negative instructor feedback, having to empathize and work on anxious patients who may also be in pain, being unable to treat all of those on the long waiting lists, and not being able to provide all patients with complex treatments due to system regulations or financial constraints. Additional stress, in some cases, is caused by emotional and personal issues as well as the financial strains of funding their studies.[1]

Both local and international literature is replete with information about the stress perceived by dental students.[2-4] Abbasi et.al. identified and reported on the high stress levels amongst dental students when compared to medical student peers.[5]

They commented that negative stress occurs when pressure is more than the person (student's) capability resulting in apprehension, insecurity and guilt which has a negative psychological impact.[5] A recent study amongst South African dental students found that a number of them who had perceived moderate to severe stress had contemplated suicide, and many were being treated for depression.[6] Other researchers discovered that some health science students have resorted to the use of

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stimulant drugs to enhance their academic performance or as a mechanism for coping with the pressure of their full schedules.[7] The drugs used by these students are often obtained from peers or acquaintances, and they are often unaware of the dangers and possible adverse effects of the medication or of drug interactions.

The use of stimulants to enhance academic performance has attracted much attention in the media in recent years. A study undertaken on medical students at a South African University revealed that 68% of the 53 students used methylphenidate (MPH) for academic purposes.[1] Bhayat and Madiba in a recent (2017) study on dental students found that 45% of respondents were identified as having felt moderate stress and 42% severe stress.[6] They also noted that 13% of respondents used recreational drugs and 3% contemplated suicide as a coping mechanism.[6]

A recent worrisome newspaper article on illegal prescription drug trade at the University where this study was carried out prompted this investigation.[8] Two schedule six drugs, Ritalin and Concerta, the highest legally scheduled drugs available in South Africa, were reported to have been illegally advertised on student WhatsApp groups and had been sold to students over the past 18 months. The perpetrators were aware of the fact that their action was illegal, but felt justified in selling as they said they were helping the many students who were suffering from depression. In addition, it served as a good source of income for them.[8]

Substance use by students

The active ingredient of Ritalin and Concerta namely MPH, is listed in the South African Drug and Drug Trafficking Act Part II as a Dangerous Dependence-Producing substance and classified together with Opium and Morphine.[9] A person who is caught using this without it being medically prescribed could be sentenced to 15 years in prison, and up to 20 years for dealers.[8]

Methylphenidate was first produced in 1944 and marketed by Ciba-Geigy Pharmaceutical Company as Ritalin. It was initially prescribed for conditions such as depression, chronic fatigue, and narcolepsy, however its use today is mainly limited to treating attention-deficit hyperactivity disorder (ADHD) in children ages 6 – 16 years. [8,9] Ritalin acts much like cocaine through its calming effect on the brain.[10-12] It does so by enhancing the uptake of the neurotransmitters, dopamine and noradrenaline in the areas of the brain which control hyperactivity.[11,13-14] Studies have also shown MPH to helps increase a person's ability to perform complicated memory-associated tasks[10,15] Others reported its benefits in helping narcoleptic patients to stay awake.[16]

Both of these effects could account for reasons that students use it when studying.[17] They may also take it to counteract the side effects of other ill-disciplined behaviour such as late night partying and heavy alcohol use in order to stay awake in sessions the next day.[1]

Unfortunately, the off-label use of MPH has not been limited to enhancing academic performance, but is also being taken for recreational purposes, and at times, in combination with other substances to produce euphoria.[7] However, it often also has adverse effects such as hallucinations, anxiety, xerostomia and visual disturbances. [18] More alarming is that if incorrect doses of the drug are taken or if it is suddenly withdrawn, it can result in severe depression, altered sleep patterns and a risk of cardiac failure or seizures.[1] Another cited danger of Ritalin use is hindered brain development.[19] The study by Mc Neil et al. reported that 87% of students who used stimulant medication like Adderall for non-medical reasons sourced it from friends and 80% reported having adverse reactions when taking the medication.[20] For this reason it is imperative that students are made aware of the consequences of the use of MPH and similar substances as well as the added dangers of drug interactions if taken in conjunction with other medication or performance enhancing substances.

To date there are few studies that examined the level of use of performance or mood enhancing substances, also referred to as "smart drugs" amongst dental students. As far as the authors could ascertain no study of this nature has ever been carried out at their home institution, and only few others had been conducted in the other South African dental schools. The aim of the study was to assess substance use by dental and oral hygiene students at this dental school in Gauteng. Specifically, to identify which substances were used, where they were obtained, frequency and reasons for use, as well as the self-perceived benefits and side effects experienced by the students after taking them.

METHODOLOGY

Ethical approval was obtained from the University, Faculty of Health Sciences Ethics committee (Ref 722/2019). Respondents were assured that all information was to be kept strictly confidential, and anonymity was guaranteed. Due to the nature of the study, contact information for the university counsellors was also given to the students in the event that they identified a need to seek professional help.

A cross-sectional study using a modified, validated, self-administered questionnaire was conducted on all consenting dental and oral hygiene students at a university in South Africa.[1,7]

The questionnaire inquired about substances or stimulants use, number and names of the products being taken, frequency of use, amounts taken, history of use, where the products were obtained, reasons for use, benefits as well as side effects experienced, and whether they had tried or wanted to stop using them. All dental and oral hygiene students from the first to the final year of study who were registered in 2019 were invited to participate in the study.

There were 302 dental students and 41 oral hygiene students registered (total of 343 students). Based on the population of 343 students, a confidence interval of 95%, and an error margin of 5%, a minimum sample size of 170 was deemed a representative sample.
Data was analysed with SPSS Version 27 using

descriptive and analytical statistical tests. The level of confidence was set at 95% with the level of significance of p< 0.05.

RESULTS

Of the 343 registered students, 303 (88%) agreed to participate. The ages ranged from 17 to 36 years (mean 22.3 years; SD ± 3.2) and two thirds (66%) were between 20 and 24 years old.

Out of the 303 students who participated, less than a third 97 (32%) reported to not using any substances, while over two thirds 206 (67.9%) were taking at least one. Almost half of the group (44.6%) only took one product, 16.5% took two, and 7% consumed between 3 and 5 (Table 1).

Almost half of the students who used substances 100 (49%) were daily users, followed by occasional users at 69 (33%), with no students reporting a once off use (Table 2). The sources cited for acquiring the substances were from "other sources / suppliers" 33 (37%), friends, peers and acquaintances 20 (8.5%), from pharmacies with a prescription 64 (31%), from pharmacies and supermarket dispensaries over the counter 36 (17.5%) and from family members 5.3% (Table 2).
Substances used were then categorised into classes according to the various names the students gave to identify each product taken. Some of the students gave the class of the substance used without naming them, and hence those were classified as unspecified (Table 3).

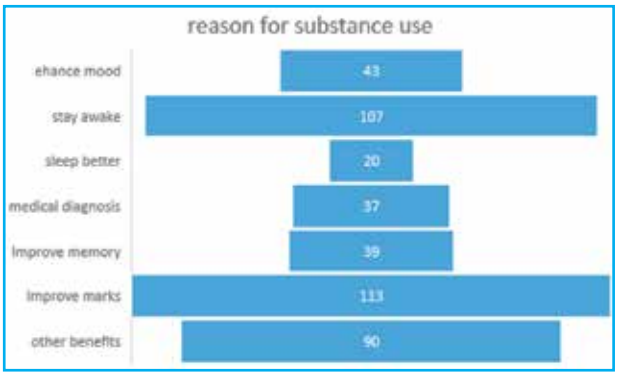

Figure 1. Reasons for use of substances / perceived benefits n=206

The substances used ranged from alcohol, anti-anxiety pills, antidepressants, natural boosters (mainly vitamins), and caffeine products including tea and coffee, tobacco products and tranquillisers. Nearly twenty percent of the students used caffeine products, energy drinks, and methylphenidate. Almost 10% used anti-anxiety pills and anti-depressants whilst just above 11% used natural boosters and multivitamins. Almost 4% specifically mentioned using marijuana, Ritalin or Concerta as examples.

More than half of the students using substances used them to stay awake and improve marks 107(51.9% and 113(54.9%) respectively. About forty percent used them for other unexplained benefits 90(43.7%). Just above 18 % of students, used them for medically diagnosed conditions and to improve memory. Some of the students used them as mood enhancers 43(20.9%), and nearly 10% of the students used them to sleep better (Figure 1).
The majority of respondents experienced headaches

Table 1: The number of substances consumed by different .students n=303

Number of substances	Number of students	%
0	97	32
1	135	44.6
2	50	16.5
3	12	4
4	8	2.6
5	1	0.3
Total	**303**	**100**

Table 2: Frequency of use and source where substances were obtained. n=206

Variable	Frequency	n (%)	Variable	Sources	n (%)
Frequency N=206	Once off	0 (0)	Sources of substances n=206	Other sources	77(37)
	Occasionally	69(33)		Acquaintances	8(3)
	Daily	100(49)		Friends	9(4)
	Weekly	26(13)		Peers	3(1.5)
	Monthly	2(1)		Prescription	64 (31%)
	Monthly	2(1)		Over the counter	36(17.5)
				Family	11(5.3)

Table 3. Classes of substances used with three specific examples. n=206

Substances	n/(%)	Substances	n/(%)	Substances	n/(%)
Alcohol	11(5.3)	Caffeine	38(18.4)	Weight loss products	1(0.5)
Analgesics	3(1.5)	Energy drinks	36(17.5)	Tranquillisers	5(2.4)
Anti-anxiety medication	16(7.8)	Methly penidate	34(16.5)		
Anti-depressants	20(9.7)	Natural de- stressors	3(1.5)		
Anti-psychotics	2(1)	Tobacco products	13(6.3)		
Boosters/ vitamins	24(11.7)	Unspecified	81(39.3)		

51(25%) followed by loss of appetite 49 (24%), anxiety 44 (22%) and xerostomia 43(21%). Close to a third had either experienced palpitations, weight loss or drowsiness [29 (14) %, 27 (13) % and 26 (13) % respectively], others reported to have suffered from depression 25(12%), nausea and vomiting 21(10%), chest pains 14(7%), memory loss 13 (6%) and abdominal pain 6 (3%). Forty-five (22%) of the users confessed that they had tried, but struggled to stop using the substances (Figure 2).

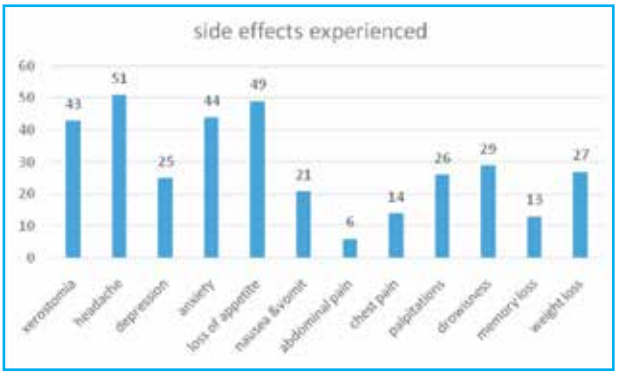

Figure 2. Side effects experienced by students from substance use. n=206

DISCUSSION

The high response rate of 88% was welcomed in terms of strengthening the validity and relevance of the data obtained. This could have been attributed to the fact that the questionnaires were handed out during lecture periods, which were compulsory at the time of the study. It is a concern that over two thirds of the students are using at least one memory or performance enhancing substance, with 31% obtaining their supplies with prescriptions.

This number was much higher than the findings of Mc Neil et al. who found only 12% of the dental students using prescription medication.[20] However their study did not consider non-prescription substance use which accounts for the disconcerting finding of 67.9% of the current study's cohort, and is perhaps a more worrying phenomenon. At the same time, their investigation was carried out almost 10 years ago. Bhayat and Madiba in 2017 investigated stress levels amongst dental students at the same institution as the current study and reported that 45% of the respondents felt moderately stressed and 42% were severely stressed.[6]

The present study also found that almost half of the respondents used substances on a daily basis and most did so in order to improve their marks, stay awake and to gain other personal benefits. They also used these substances despite the fact that they are students in the health care sector and as such should be aware of the associated risks. Furthermore, more than half of them experienced many adverse side effects, most notably headache, loss of appetite, xerostomia and depression. Yet despite this, they chose to continue with their habits with less that one fifth of them having reportedly tried to quit.

There are also a number of additional unsubstantiated issues to consider. It is also possible that students under-reported their consumption patterns of substances due to them knowing about the harmful health effects and / or their illegal acquisition. Response acquiescence is common among questionnaires that investigate habits that are considered taboo or have negative connotations. This study also did not consider substances used in other "non-oral" forms, such as nasal inhalation or intravenous injections. Neither did it elicit the actual dosages or volumes of the substances used, which could vary widely between different products and students.

Subsequent to undertaking this investigation the world met with the year 2020 and Covid-19. This pandemic, along with the ensuing social isolation, class size and number restrictions, limited university access, and reliance on distance learning has had dire negative consequences on education in general, and dentistry in particular. While it has been possible for educators to adjust and tailor their didactic input to suit the "new normal" situation, it was virtually impossible to teach the manual skills associated with this profession. Many students also struggled to access the digital platform due to personal limitations with technology, finances or internal abilities. They also experienced extreme anxiety and fear that they would not be able to develop the necessary skills and confidence needed to enter the clinics, nor to have the time and capabilities to achieve the requisite clinical quotas. The added social isolation left many without peer or academic staff support, and no doubt could have added to their feelings of being alone in their plight.

CONCLUSION

This study revealed high levels and frequency of substance use amongst dental and oral hygiene students, which must be seen as a concern for dental educators. It may now be the opportune time to reflect on the current curriculum and see where the "old school shibboleths" can be removed to accommodate replacement with the new and ever-increasing technological advances. It is also crucial to introduce more structured life-orientation courses to equip students with the necessary emotional and mental aptitude needed to deal with stressors associated with their studies as well as those they may anticipate in their future careers.

The findings of this study, along with the background of the last 2 years, almost make it obligatory for educators to conduct a similar study with the present cohort of dental and oral hygiene students. It will then be interesting to compare the results of substance use and acquisition, as well as elicit if the students have developed other positive or negative stress management and coping strategies.

Limitations

This study is limited by the cross-sectional study design, and causality cannot be inferred. The study did not collect information on gender, race, residence, or socio-economic demographics. A further limitation was that the results were pooled and not analysed separately for each course or level of study. The latter may have been useful in order to compare substances use between the classes. Despite these restraints, the study provided useful information that may inform future health

promotion approaches, and introduction of more courses offering life-orientation and coping skills at the institution.

Conflicts of interest

The authors declare that there are no conflicts of interest.

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Dental students' experiences of remote emergency online learning at the University of the Witwatersrand during the COVID-19 pandemic

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K Tshite[1], A Z George[2]

ABSTRACT

Introduction

The challenges presented by the COVID-19 pandemic provide opportunities to improve dental education.

Aim

This study explored students' experiences of emergency remote learning (ERL).

Methods

A descriptive, cross-sectional, online survey was sent to 154 Bachelor of Dentistry students at the University of the Witwatersrand in October 2020. The questionnaire included questions about demographics and 25 questions about device ownership, data and Internet usage, online teaching and learning experiences, and future needs. Quantitative and qualitative data were analysed using descriptive and inferential tests and content analysis.

Results

The survey response rate was 67.5% (99/154). After ERL, 63.3% fewer respondents preferred contact teaching over online teaching, while more preferred mostly online (percentage change of 216.7%) and some online components (percentage change of 80.6%). The number of respondents with no preferred modality decreased by 88.2% from before to after ERL. Respondents' main reasons for preferring contact learning before ERL (n=51) were that it 'allows more interaction' (n=30) and having had 'no or limited experience of online learning' (n=9). Beyond ERL, the main reason for preferring online learning was 'promotes effective learning' (n=20).

Conclusion

Changes in respondents' preferred teaching modalities after ERL have important implications for integrating online learning into the dental curriculum.

Keywords: COVID-19; Dental education; Emergency remote learning; Online learning; Blended learning; South Africa

List of abbreviations

YOS: Year of study
VoPP: Voice-over PowerPoint
SOHS: School of Oral Health Sciences
ERL: Emergency remote learning
BDS: Bachelor of Dental Science
SA: South Africa
Wits University: University of the Witwatersrand

INTRODUCTION

The unprecedented educational challenges presented by the COVID-19 pandemic provide opportunities to strengthen dental teaching and learning.[1–3] Dental educators' need to find contextually appropriate solutions for the myriad problems they encountered during the pandemic resulted in a plethora of papers. Most of the papers on dental education during the pandemic came from high-income countries;[4] for example, almost half (63/135; 46.7%) of the single-country original research papers in one scoping review from more than 30 countries were from 12 high-income countries.[3] Egypt (one single country paper and one collaboration between Egypt and Saudi Arabia) and Nigeria (three cross-sectional studies) were the only African countries included in the scoping review; both are low-income countries.[5]

South Africa (SA), although classified by the World Bank as an upper-middle-income country,[6] is the most unequal country in the world,[7] making it vital to use student experiences during the pandemic to improve higher education and make it more equitable. As advocated by Peres et al,[9] within the context of dental education during the pandemic, it is necessary to learn from shared

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2. Ann Z George: 50%

experiences. A recent survey reported on undergraduate dental therapy and oral hygiene students' perspectives on incorporating blended learning during the COVID-19 pandemic at a South African university.[8] This paper from the School of Oral Health Sciences (SOHS) at the University of the Witwatersrand (Wits University) aims to contribute to the national, and possibly international, discourse about the challenges and opportunities for dental education revealed during the period of emergency remote learning (ERL).

The challenges experienced during ERL included concerns about the quality of teaching and learning, staff and students' mental health, and infection control.[3,10] Concerns about the quality of teaching and learning focused on institutional, teacher and student readiness for remote online learning and the impact of systemic inequalities on learning. Blended learning, commonly thought of in terms of Graham's[11] definition of combining face-to-face and online teaching, is the preferred method of integrating online learning in the health professions.[12] However, Garrison and Kanuka's[13] definition of blended learning introduced a vital quality dimension and intentional design: "thoughtful integration of classroom face-to-face learning experiences with online learning experiences." The idea of intentional design for blended learning interactions differentiates blended learning from enhanced classroom teaching, on the one hand, and fully online learning, on the other.[14]

Whether referring to completely online teaching or a component of blended learning, the quality dimension of online learning is based on its potential to promote deep or meaningful learning when used in constructivist pedagogical ways.[14–16] The constructivist principles that underpin meaningful learning require students to engage with concepts in ways that promote the construction of knowledge.[17] Online learning is mistakenly believed to be "a representative metaphor of constructivism where the subject of learning is shifted from the teacher to the student, emphasising the autonomous, reflective, and responsible role of the student."[18] Online learning is not inherently constructivist.[19] Rather, educators must design online learning interactions that facilitate knowledge construction,[20] which requires adequate technological and pedagogical knowledge.[21] Clinical skills videos demonstrating technical skills as examples of best practices,[22,23] could, for, example have been used to alleviate dental educators' challenges in continuing clinical teaching during ERL. However, this would require adequate technological and pedagogical knowledge and levels of resources, planning, and preparation that may not always have been possible during the pandemic.

Digital inequality across societies has been attributed to economic, social, geographical, and generational divides.[24] These inequalities became more visible during the pandemic when students were required to work from home, drawing attention to rural/urban differences.[10] The Organisation for Economic Cooperation and Development identified a digital divide called the digital gender divide, which refers to discrimination that prevents women from realising equal benefits from emergent digital opportunities.[25] Women are still subjected to socio-cultural norms and a lack of education, which can be exacerbated in crises. In addition, women often bear household burdens that would affect female students' ability to study at home more than males.[24]

Given the challenges faced during ERL and the dearth of information about South African dental students' experiences, it is essential to determine what lessons can be learned to enhance dental education.

AIM OF THE STUDY

This study explored dental students' experiences of ERL during SA's first wave of the pandemic, from 26 March to 1 August 2020. The study's objectives were to determine students' experiences of online teaching and learning and their needs for future teaching.

CONTEXT OF THE STUDY

The School of Oral Health Sciences at Wits University is one of four South African dental schools offering the Bachelor of Dental Science (BDS) or the equivalent Bachelor of Dental Surgery (BChD). The first two years of the five-year BDS programme at Wits University include mainly theory and pre-clinical teaching, conducted in the skills laboratories at the Charlotte Maxeke Academic Hospital. The final three years of the BDS focus on clinical training in four polyclinics at Charlotte Maxeke Johannesburg Academic Hospital.

South Africa went into total lockdown at midnight on 26 March 2020, suspending all contact teaching. Dental and medical students resumed clinical training on 1 August 2020. Wits University responded to the lockdown by implementing a laptop programme and providing students and staff with 30GB of data monthly. The University's Faculty of Health Sciences invited all staff to attend training on multiple online teaching methods, including creating voice-over PowerPoint (VoPP) presentations, to facilitate the rapid transition to ERL and the effective use of the learning management system in use at the time. Despite the university's efforts to support teachers and students, institutional barriers were identified. Banda[26] pointed out that Wits University's legacy IT infrastructure could not fully support online learning and teaching during the early stages of the pandemic.

METHODS

Ethics

The Human Research Ethics Committee (Medical) of the Faculty of Health Sciences at Wits University approved the study (M191154).

Study design and sampling

A descriptive, cross-sectional, convergent mixed methods online survey with closed- and open-ended questions was sent to a purposive sample of 154 BDS students registered in 2020, all of whom were eligible to participate in the study. The quantitative and qualitative findings were converged to improve our understanding of dental students' experiences of online teaching and learning during ERL.[27] Epi Info was used to calculate an estimated sample size of 111 using a 5% margin of error and a confidence level of 95%.

Development and administration of the survey

The survey was developed in and administered using REDCap electronic data capture tools hosted at Wits University. The questionnaire was adapted from a 2017 survey of Wits University medical students' readiness for e-learning,[28] which had been based on the published studies of Farley et al[29] and Dahlstrom et al.[30] The Ingratta et al 2017 survey[28] was modified for relevance to dental education during the period of ERL. The questionnaire used in this study consisted of 25 questions about students' device ownership, internet and data usage, their experiences of online teaching and learning before and during ERL and their perceived needs for teaching and learning beyond ERL. The questions were face validated by an experienced researcher to improve validity.[31] Demographic data were also collected. Feedback from a pilot study was used to modify the questions.

Data collection

The survey was emailed to students in early October 2020 and remained open until 10 December 2020. The university registrar provided permission to access students' emails from the SOHS. The first screen of the survey consisted of an information sheet. Students had to consent to participate in the study before continuing the survey.

Data analysis

The data were exported to Microsoft Excel for cleaning. There were no duplicate entries. Five incomplete entries (more than half of the answers missing) were removed from the dataset. The closed-ended questions were analysed using descriptive statistics and tests of significance in IBM SPSS. [27] Frequency and custom tables were used to analyse and present students' demographics. The Kruskal-Wallis ANOVA test was used to compare student device ownership and device usage by year of study. The Mann-Whitney U test was used to compare students' device ownership and usage by gender. Associations were tested using chi-squared tests; the Fisher's exact test result was reported where expected counts were less than 5%. All tests were conducted at a significance level of

Table 1. Sample and population demographics

Variables												
Age												
≤19 years	8 (40)	NR	2 (18,2)	NR	0	NR	0	NR	0	NR	10 (10.1)	NR
20-24 years	9 (45)	NR	8 (72.7)	NR	24 (82.8)	NR	18 (81.8)	NR	10 (58.8)	NR	69 (69.7)	NR
25-29 years	1 (5)	NR	1 (9.1)	NR	4 (13.8)	NR	3 (13.6)	NR	4 (23.5)	NR	13 (13.1)	NR
≥30 years	2 (10)	NR	0	NR	1 (3.4)	NR	1 (4.5)	NR	3 (17.6)	NR	7 (7.1)	NR
Population group#												
African	14 (70)	23 (63.9)	6 (54.5)	25 (67.7)	16 (55.2)	13 (40.6)	9 (40.91)	7 (31.8)	7 (41.2)	5 (16.1)	52 (52.5)	73 (46.2)
Indian	3 (15)	4 (11.1)	2 (18.2)	5 (13.5)	7 (24.1)	13 (40.6)	9 (40.91)	10 (45.5)	6 (35.3)	24 (77.4)	27 (27.3)	56 (35.4)
White	2 (10)	7 (19.4)	1 (9.1)	2 (5.4)	2 (6.9)	5 (15.6)	3 (13.64)	2 (9.1)	2 (11.8)	2 (6.5)	10 (10.1)	18 (11.4)
Coloured	1 (5)	2 (5.6)	1 (9.1)	5 (13.5)	4 (13.8)	1 (3.1)	0	1 (4.5)	0	0	6 (6.1)	9 (5.7)
Asian	NA	0	NA	0	NA	0	NA	2 (9.1)	NA	0	NA	2 (1.3)
Prefer not to say	0	0	1 (9.1)	0	0	0	1 (4.5)	0	2 (11.82)	0	4 (4.0)	0
Gender												
Male	5 (25)	14 (38.9)	3 (27.3)	11 (29.7)	6 (20.7)	14 (43.8)	10 (45.5)	3 (13.6)	2 (11.8)	9 (29.0)	26 (26.3)	51 (32.3)
Female	15 (75)	22 (61.1)	8 (72.7)	26 (70.3)	23 (79.3)	18 (56.3)	12 (55.5)	19 (86.4)	15 (88.2)	22 (71.0)	73 (73.7)	107 (67.7)
Other	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA
Residence when at the university												
Campus residence	6 (30)	17 (47.2)	5 (45.5)	2 (5.4)	5 (17.2)	0	7 (31.8)	0	4 (23.5)	0	27 (27.3)	19 (12.0)
Off-campus	14 (70)	19 (52.8)	6 (54.5)	35 (946)	24 (82.8)	32 (100)	15 (68.2)	22 (100)	13 (76.5)	31 (100)	72 (72.7)	139 (87.9)
Location during the pandemic												
Urban	15 (75)	NR	7 (63.6)	NR	26 (89.7)	NR	17 (77.3)	NR	16 (94.1)	NR	81 (81.8)	NR
Rural	5 (25)	NR	4 (36.4)	NR	3 (10.3)	NR	5 (22.7)	NR	1 (5.9)	NR	18 (18.2)	NR
No response	0	NR	0	NR	0	NR	0	NR	0	NR	0	NR

*The population data at admission supplied by the university's Business Intelligence Service (BIS) (n = 158) was used to compare the sample to the population (n = 154) for all variables except age and location during the pandemic, which were deemed not relevant (NR) to establish the representativeness of the sample.

Required demographics not available in the datasets are denoted by NA.

#The racial classifications of African and Coloured (mixed race) were introduced during the apartheid era (1947–1994) according to the Population Registration Act (No. 30 of 1950). The terms for the different population groups as previously defined by the apartheid system are still in use to assist the South African government with redress of previously disadvantaged population groups.

$p \leq 0.05$. Crosstabs and bar charts were used to analyse further the differences in students' use of online learning. The open-ended answers were analysed in Microsoft Excel using content analysis to generate counts of categories of respondents' experiences of online learning.[32] All coding by the primary investigator was checked iteratively by an experienced researcher until intercoder-agreement was reached, to improve the reliability of the study.[27]

RESULTS

The response rate for the survey was 67.5% (99/154). Most of the respondents were African (52.5%), female (73.7%), and 20-24 years old (69.7%) (see Table 1). More than 70% lived off-campus when attending university (72.7%), while more than 80% were located in urban areas during the lockdown period when the university was closed (81.8%). The sample was broadly representative of the population for population group and gender, with a slight over-representation of females (73.7%) compared with the survey population (67.7%). Students from the Indian population group were under-represented in the sample (27.3% versus 35.4%), while those defined as African students were over-represented (52.5% versus 46.2%). More respondents lived in campus residences while at university than off-campus, compared with the population data, suggesting that some students had moved into campus residences after admission.

Access to online materials

Laptops (75%) were the primary devices across all years of study, followed by smartphones (16%). Thirteen respondents (13%) indicated that the university provided the laptops they used during ERL. Few respondents used tablets and desktops across all years of study (see Figure 1). A Kruskal-Wallis one-way ANOVA comparing the mean scores for the device used during ERL by the year of study was not statistically significant ($p = 0.505$).

Seventy-nine percent of the respondents used the 30GB of data supplied by the university. Respondents' usage of the 30GB of university-supplied data was not statistically significant across the years of study ($p = 0.333$). No statistically significant differences were observed when respondents' monthly data usage was compared by year of study ($p = 0.506$). Respondents' usage of the university-supplied data by geographical location during ERL was also not significant ($p < 0.756$), suggesting that urban or rural location did not affect respondents' usage of the data provided by the university.

More than half (51.5%) of the respondents accessed the internet using home Wi-Fi networks, data that they had purchased (5.1%) or the 30GB of data provided by the university (14.1%), with 29.3% reporting that they had to buy data to supplement the university-supplied data. There was no statistically significant difference in internet connection type by year of study (YOS) ($p = 0.803$). No statistically significant difference was observed between male and female participants on the type of internet connection used ($p = 0.872$). This finding suggests that all students used similar connection methods to connect to the internet. There was, however, a significant difference between the students' geographical location during ERL and the type of internet connection they used ($p = 0.004$).

Most respondents reported that they carried out online academic work daily for 3–4 hours (38.4%), while 21.2% spent less than 3 hours online, 22.2% spent between 5–6 hours, 8.1% spent 7–8 hours, 4.0% spent more than 8 hours, and 6.1% indicated 'other' periods of time spent online. A Mann-Whitney U test comparing the mean scores for the number of hours spent online, by gender, was not statistically significant ($p = 0.168$).

Nearly all respondents (88.8%) accessed the internet for academic work between 06h00 and 19h00, with 65% working between 19h00 and 06h00. About one-fifth of respondents (21.2%) accessed the internet between 02h00 and 06h00 when they could utilise free data equivalent to the data bundle purchased on the service provider's special offer, which extended between 24h00–05h00.

Experiences of emergency remote learning

Figure 1 shows the six categories of responses when respondents were asked what they enjoyed about teaching and learning during ERL (n = 107). The primary reason for enjoying online learning was the 'flexibility of working online' (n = 55), followed by the 'benefits of working at home' (n = 18) and the 'attributes of specific online learning methods' (n = 10). One student's response illustrated how combining different online learning methods benefitted their learning:

…if there was a topic that I did not understand, I could refer to the voice-over lectures and get a response from a tutor on the forums immediately, and the tests and quizzes

Figure 1. Reasons for use of substances / perceived benefits n=206

Table 2. Preferred methods of online teaching and learning during ERL (n = 99)

Teaching method	BDS1 (n = 20) %	BDS2 (n = 11) %	BDS3 (n = 29) %	BDS4 (n = 22) %	BDS5 (n = 17) %	Total (n = 99) (n; %)
Tests and quizzes	40.0	9.1	27.6	40.9	29.4	31 (31.3)
Voice-over PowerPoint Presentations	35.0	45.5	37.9	22.7	5.9	29 (29.3)
Online meetings	10.0	18.2	20.7	18.2	29.4	19 (19.2)
Other	5.0	18.2	6.9	9.1	5.9	8 (8.1)
Assignments	0	0	3.4	4.5	29.4	7 (7.1)
Videos	10.0	9.1	3.4	4.5	0	5 (5.1)

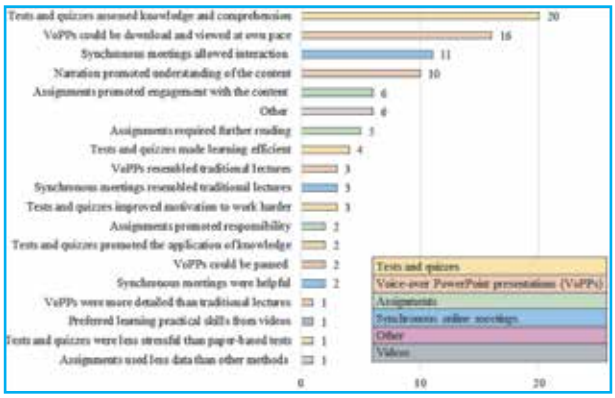

Figure 2. Reasons for preferring different methods of learning online (n = 99)

allowed me to keep up with studying the content. Table 2 shows respondents' preferences for specific online methods of teaching and learning used during ERL by YOS. There was no statistically significant difference for most useful online method by YOS (p = 0.245).

Respondents' reasons for preferring specific online learning methods (n = 99) are shown in Figure 2. They mainly valued tests and quizzes (n = 30) because they assessed knowledge and comprehension (n = 20), and VoPP presentations (n = 26) because they could download the presentations and view them as needed (n = 16) and the 'narration promoted understanding of the content' (n = 9). The main reason for preferring synchronous online meetings (n = 16) was because they 'allowed interaction' with lecturers and peers (n = 11), while assignments (n = 14) were deemed to have 'promoted engagement with the content' (n = 6). Interestingly, one reason for preferring VoPPs and synchronous meetings was because they resembled traditional lectures (n = 3, for both). The 'Other' (n = 6) subcategory comprised responses that did not answer the question.

Figure 3 shows the three categories of challenges (n = 147) respondents faced during the period of ERL: 'Difficulties accessing the online content' (n = 76), 'Difficulties adjusting to working at home' (n = 37) and 'Challenges with learning online' (n = 32). Irrelevant responses were classified as 'Other' (n = 2). 'Network and connectivity issues' (n = 61) were the major obstacle to accessing the online content, followed by 'insufficient data' (n = 7). The major difficulty adjusting to learning at home (n = 34) related to 'difficulties managing time' (n = 16), with one student referring to the

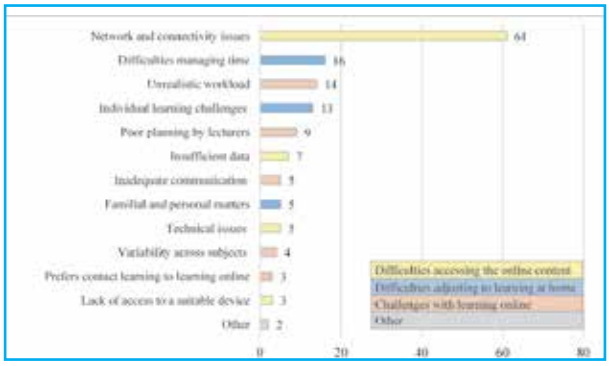

Figure 3. Online learning challenges during ERL (n = 147)

"distractions from family members during work time." Another major difficulty adjusting to learning at home (n = 34) was 'individual learning challenges' (n = 13), with examples like "working and studying and household chores whilst going through family losses" and "job losses during the COVID period." The major challenges with learning online were the 'unrealistic workload' (n = 14), which one student described as "too much work, too little time," while another mentioned the "EXCESS WORK LOAD [sic]."

Preferred learning modality before and after ERL

Before ERL, 'Contact teaching' (37.5%) was the preferred modality, followed closely by courses with 'Some online course components' (31.3%) (see Figure 4). In addition, more than one-fifth of respondents indicated 'No preference' (21.3%) for either the contact or online modality, before ERL. Comparing the percentage changes from before to after ERL, 63.3% fewer respondents preferred contact teaching, while all the categories involving online teaching increased. The most striking changes were a 216.7% increase in those wanting 'Mostly but not completely online' courses and an 80.6% increase in those wanting 'Some online course components.' The number of respondents with 'No preference' decreased by 88.2%. Entirely online courses were the least preferred learning modality before and after ERL.

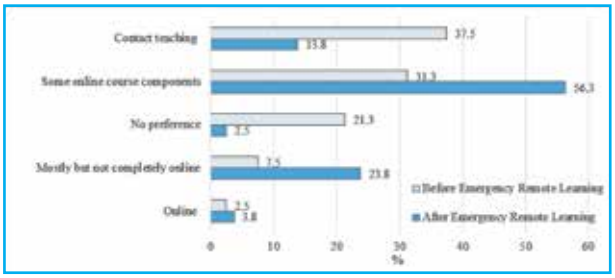

Figure 4. Preferred teaching modality before and after emergency remote learning (n = 80)

Respondents' main reasons for preferring contact over online learning before ERL (n = 51) were that it 'Allows more interaction' (n = 30) and having had 'No or limited experience of online learning' (n = 9). Other reasons were that contact learning was perceived as being 'Better structured' (n = 4) and involving a 'Reduced workload' (n = 4), while 'Online learning posed too many challenges' (n = 3). There was also a preference for hard copies of

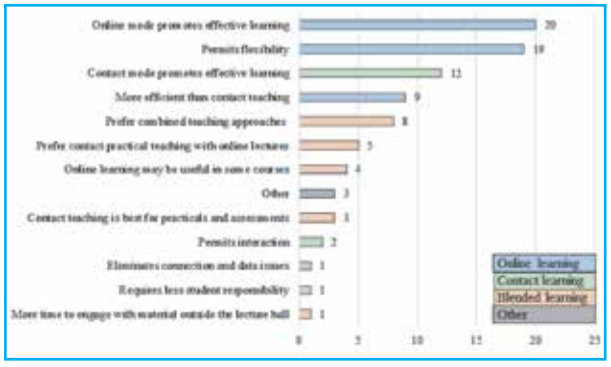

Figure 5. Reasons for learning modality preference after emergency remote learning (n=88)

notes (n = 1). Respondents' reasons for preferring online learning before ERL (n = 19) were that it 'allows greater student autonomy' (n = 7), 'promotes learning better' (n = 7), a perception that 'contact sessions were not useful' (n = 3) and that uploaded resources were useful (n = 2).

Beyond ERL, respondents' reasons (n = 88) in support of online learning, contact learning and blended learning are depicted in Figure 5. The main reasons for preferring online learning were that it 'promotes effective learning' (n = 20), although the same was said of contact learning (n = 12). Where students felt that online learning promotes effective learning, their reasons were, for example, that it "facilitates comprehension", while they felt that contact learning "eliminates connection issues." Other reasons for preferring online learning were that it 'permits flexibility' (n = 19), is 'more efficient than contact teaching' (n = 9) and 'permits interaction' (n = 2). Respondents valued blended learning because they 'prefer combined teaching approaches' (n = 8) and 'contact practical teaching with online lectures' (n = 5).

Figure 6. Needs to facilitate online learning in the future (n = 73)

When asked what they needed to facilitate online learning in the future (see Figure 6), the biggest category 'Better learning design' (n = 34) included needs relating to 'better workload planning' (n = 10). Concerning better workload planning, students requested, for example, a "fair workload" and a "good online timetable." One respondent's comment (see below) included several needs relating to 'changes to the structure of learning interactions' (n = 8). The student wanted more participation from lecturers and indicated a preference for synchronous online sessions:

Simply publishing a PowerPoint on Sakai and saying, "I've posted the lecture, if you have any questions, you can email me directly or through your class rep,"[sic] no, do voice-overs AND have a virtual Q&A. The Big Blue Button live lectures were so good.

The main change respondents felt they needed in the future was 'Changes to data provision' (n = 16). One student said they need an "adequate amount of data." Other changes respondents wanted related to the category 'Improved online access' (n = 30): a 'Better internet connection' (n = 9) and the 'Provision of suitable devices' (n = 3).

DISCUSSION

The period of ERL has resulted in substantial changes in the higher education system, as evidenced by the dramatic shifts in respondents' preference from contact learning to blended learning and the reduction in those who had indicated no preference for either modality before ERL. Notwithstanding the challenges of the extreme conditions under which teaching and learning took place during the pandemic, ERL has served as a metaphorical test tube, an incubator of ideas,[33] about the possibilities of how online learning can be used to enhance traditional dental teaching. The fact that respondents indicated they wanted more blended learning despite the myriad challenges they experienced appears to centre around the flexibility of working at their own pace, combined with the variety of online learning methods and resources available to them, especially tests and quizzes and VoPP presentations.

These findings are similar to those of Mladenovic et al;[34] more than 90% of the students in that study reported that the ready accessibility of online PowerPoint presentations allowed them to work at their own pace and further explore interest topics. In their study integrating learning management systems into dental simulation clinics, Pani and Vieira[35] found that uploading pre-readings and case scenarios allowed more focused discussions and better time management. Their students could prepare better for discussion sessions and interact more productively with lecturers and peers. While the Pani and Viera[35] study illustrates the judicious use of online resources, educators must be realistic about the time required for online work. The unrealistic workload cited by respondents in this study could be counterproductive to deep or meaningful learning.[36]

Spalding et al,[37] in their study of the higher education challenges and possibilities in Brazil during the pandemic, recommended changes in the conceptions of learning and teaching as a strategy for focusing on mental health in the education system. In keeping with what has been reported in other studies, both pre-pandemic[22,23] and during the pandemic, the respondents in our study indicated that the shift towards blended learning should focus on teaching theoretical components online while clinical teaching is conducted in person.

The dental students in the survey conducted at the University of KwaZulu-Natal referred to the stress of switching between lectures and clinics during traditional teaching, both in the time required and the possible negative impact on their learning, which blended learning modalities could alleviate.[8] However, the students in this study felt that fully online teaching could not adequately prepare them for clinical practice.[8] The idea that while some dental courses require contact teaching, others—like Prosthodontics, Restorative, Practice Management, Oral Pathology, and General Practice—could continue online in the future was supported by third- and fourth-year students in the United States study by Gardner et al.38 Although videos were the least preferred method of online learning in the Gardner et al study, their potential needs to be explored more fully, especially where the videos have been designed to meet specific needs. In our

study, the pre-clinical first- and second-year respondents preferred learning from videos more than those in the clinical years. This preference could be due to the first- and second-year students having access to pre-clinical skills videos specially recorded by lecturers in the SOHS to allow continuity of teaching and learning during the pandemic. Pre-clinical skills videos provide an opportunity for enhancing learning that could be further explored in the future.

The ERL period highlighted the inequalities still prevalent in SA, which must be considered in all educational planning. SA remains one of the most unequal countries globally regardless of the long-term trend indicating progress in reducing poverty, which is higher in rural areas.[10] Connectivity issues were a major challenge for the respondents in this study. The University of KwaZulu-Natal study by Moodley et al[8] reported a similar finding. While Wits University was not unique in its lack of readiness for the period of ERL, its laptop programme and data provision initiative supported students to continue their education.

This study found no significant difference in the type of device used by dental students and their usage of the 30GB of university-supplied data by YOS. However, some students had to purchase supplementary data to complete their academic work, raising the question of whether the blanket provision of 30GB was sufficient across all courses and all years of study. This study shows that the non-clinical YOS at SOHS utilised more videos, requiring more data than the clinical YOS. The blanket approach of providing equivalent data bundles across all years of study may not be efficient. While recent reports suggest that the government plans to provide free data to SA households,[39] this has yet to be implemented, and the consistently high data prices in SA40,[41] remain a contributing factor to unequal education. To avoid perpetuating the digital divide, the country needs to emphasise the socio-economic discourse underpinning online learning. One outcome that should address some of the technical problems experienced during ERL at Wits University was the replacement of the learning management system, Sakai, with the university's instance of Canvas, known as Ulwazi, in January 2021.

Although some students enjoyed the flexibility of working from home, others felt that their home environment was not conducive to deep learning. Many had experienced difficulties adjusting to working at home due to domestic and family responsibilities. These findings were similar to the University of KwaZulu-Natal study by Moodley et al,8 in which participants reported struggling with working from home for similar reasons. The technical difficulties students experienced also contributed to the ineffectiveness of working from home, resulting in students being unable to submit academic tasks on time. Students reported that they would have appreciated more affective teaching, whereby lecturers show compassion regarding issues beyond students' control.

Studies similar to the one reported in this paper are essential for guiding institutional decisions about how to implement blended learning in the future. Some recommendations that could be explored are implementing policies that include more staff training on online teaching platforms and digital pedagogies and ongoing critical analysis of student feedback for optimum teaching methods according to the YOS. Issues around access to technology and connectivity go beyond revising university policies on online learning and require local and national government intervention; otherwise, the disadvantaged will remain disadvantaged.A limitation of using self-reported data is its subjectivity.[42] Issues of validity and reliability were addressed to improve the credibility of the findings, and the convergence of the qualitative and quantitative findings further improved the study's rigour.

CONCLUSION

This study provides direction based on students' needs for blended learning within the SOHS and the Faculty of Health Sciences. Educators need training on designing effective blended-learning interactions, especially about what constitutes a reasonable workload. While the challenges identified during ERL were unique, especially in terms of geographical location, they provided a worst-case scenario that higher education, especially disciplines with a substantial practical teaching component, must be able to withstand. The sudden shift to ERL should be viewed as a learning curve to harness the advantages of online learning. These findings could be relevant to other national and international dental schools, especially in settings with limited resources.

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Conflict of interest

The authors declare that they have no conflict of interest related to any aspect of this research project.

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An epidemiological analysis of patients diagnosed with periodontitis at a tertiary institution

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ABSTRACT

Introduction

An analysis of the epidemiological factors associated with the diagnosis of periodontitis is important baseline evidence for the study of this disease within our population. This evidence will be valuable baseline information to inform intervention protocols that are contextual to our society. There is a scarcity of studies on periodontitis in South Africans.

Aims and objectives

To describe the epidemiological and clinical characteristics of periodontitis patients diagnosed between 2014-2019 at a tertiary institution in SA. Design. A retrospective records-based study was conducted.

Methods

Data from 450 patients diagnosed with periodontitis were extracted. Data sets including age, sex, smoking, presence of diabetes, and other systemic diseases were analysed. Periodontal parameters such as plaque score, plaque index, gingival bleeding score, gingival index, number of missing teeth, probing depths, and clinical attachment loss were included for analysis.

Results

Males had higher bleeding index (p=0.035), deeper pockets (p=0.003), and more attachment loss (p<0.001), compared to females. Deeper periodontal pockets were observed in patients with systemic diseases (p=0.018). Smokers had a lower bleeding percentage (p=0.039). There was a higher plaque percentage (p=0.031), and bleeding index (p=0.043), deeper pockets (p<0.001) and more attachment loss (p<0.001) in patients with diabetes mellitus.

Conclusion

Worse periodontal status was observed in males, and patients with diabetes or other general diseases. Additional research is required to elucidate the role of sex and systemic conditions as predisposing factors to periodontitis.

Keywords

Epidemiology periodontitis, Adult periodontitis, Periodontal attachment loss, Prevalence periodontitis, Risk factors periodontitis, Smoking periodontitis, Diabetes periodontitis, Sex periodontitis, Systemic disease periodontitis, Hypertension periodontitis

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INTRODUCTION

Periodontal diseases are among the most ubiquitous conditions of humankind. It constitutes a public health challenge, affecting 20-50% of adults worldwide to some degree.[1] Periodontitis has local and general consequences in the body, as it can contribute to inflammation, and lower quality of life, with the potential to affect multiple conditions, such as cardiovascular disease,[2] diabetes,[3] cognitive impairment,[4] pregnancy outcomes,[5] cancer,[6] respiratory diseases,[7] metabolic syndrome,[8] rheumatoid arthritis,[9] and chronic kidney disease.[10,11]

Interindividual differences in the susceptibility to periodontitis highlight the importance of risk factors in the development, evolution, and severity of the disease. The most studied risk factors for periodontitis include sex, smoking, diabetes, alcohol intake, nutritional deficiencies, obesity, and stress.[12] An increased comprehension of predisposing factors is essential for clinicians to identify individuals at risk and create specific strategies to help prevent disease, decrease its severity, and ultimately restore health.[13]

Several studies have reported a strong link between dental plaque and gingival inflammation, regardless of sex, age, or racial/ethnic background.[14–16] Although the accumulation of dental plaque is typically the first

step in the development of gingival inflammation, the progression from gingivitis to periodontitis is host dependent. The relation between the host response and the microbiota is modulated by genetic and environmental factors, including older age, male sex, stress, genetics, ethnicity, smoking, socioeconomic status, presence of diabetes, and other systemic diseases.[17–22]

Periodontal infections can induce bacteraemia, elevate white blood cell counts, increase expression of local and systemic pro-inflammatory cytokines, with the potential to decrease endothelial structure, general metabolism, platelet behaviour, coagulation, oxidative stress, and general inflammation.[23] Therefore, despite the current lack of knowledge on the exact pathways through which periodontal disease can be detrimental to general health, research supports its role as a contributing risk factor for systemic diseases.

Thus, systemic diseases can contribute to changes that predispose to periodontal destruction, while periodontitis might also influence the course of systemic diseases. Despite the non-modifiable nature of some risk factors, lifestyle and systemic factors can be addressed in patient care. There is a scarcity of studies on risk factors and risk indicators on periodontitis in South Africans, therefore it is crucial to report the epidemiological determinants of patients diagnosed with periodontitis in South Africa. The present study aims to describe the epidemiological determinants and clinical characteristics of patients diagnosed with periodontitis from 2014 to 2019 at a tertiary institution in South Africa.

MATERIAL AND METHODS

Data collection and analysis

This study was a retrospective, descriptive, analytic study, all data were collected from the patients' files at the Faculty of Dentistry, University of the Western Cape, from 2014 to 2019, and recorded in a Microsoft Excel® sheet. The study was approved by the the Biomedical Research Ethics Committee of the University of the Western Cape (Ethics Reference Number: BM20/8/4).

The data included patient age, sex, smoking status (smoker - a participant who had smoked over five packs of cigarettes [100 cigarettes] in his/her life and currently smoked over 1 cigarette/day at the time of the study; non-smoker – all remaining patients according to Kim & Jung [2013]24, number of missing teeth, presence of diabetes and systemic disease.

The following clinical parameters were extracted from each patient's records:

- Probing depth (PD): values were recorded at six sites per tooth (mesiobuccal, mid buccal, distobuccal, mesiolingual, mid lingual, distolingual).
- • Plaque percentage score and Silness-Löe plaque index: values were recorded at six sites per tooth (mesiobuccal, mid buccal, distobuccal, mesiolingual, mid lingual, distolingual).
- Bleeding percentage score and Löe-Silness gingival index: values were recorded 30 seconds after periodontal probing at six sites per tooth (mesiobuccal, mid buccal, distobuccal, mesiolingual, mid lingual, distolingual).
- Clinical attachment level (CAL) was measured as the distance from the cementoenamel junction (CEJ) to the bottom of the periodontal pocket.

Inclusion and exclusion criteria

Records of patients who had been diagnosed with periodontitis between 2014 and 2019 at the Faculty of Dentistry were included. The umbrella term "periodontitis" includes all forms of periodontitis. Patients diagnosed according to the periodontal classifications of 1999 and 2017 were included. Only the initial periodontal chart was captured for study participants. Charts from both undergraduate and post-graduate students were included.

Records prior to 2014 and after 2019 were excluded. Patients who were not diagnosed with periodontitis were excluded from the study. Folders that did not present all relevant information were excluded.

Statistical analysis

Summary statistics for categorical data were presented as frequencies and percentages. Continuous data was presented as means and standard deviations. The outcome variables were plaque percentage score, plaque index, bleeding percentage score, gingival index, pocket depth, clinical attachment loss, and the number of missing teeth. Bivariate analysis was performed to evaluate the outcome variables according to sex, smoking status, diabetes, and systemic diseases using independent samples t-test, paired t-test, Welch t-test, ANOVA, or Kruskal Wallis test. All the statistical tests were conducted using StataCorp. 2017 (Stata Statistical Software: Release 15. College Station, TX: StataCorp LLC). Statistical results were considered significant at $p<0.05$.

RESULTS

There were 603 patients diagnosed with periodontitis at the Faculty of Dentistry, the University of the Western Cape, between 2014 and 2019, however, 450 patients' data were complete and included in this analysis. In total, 246 were females (54.7%) and 204 were males (45.3%). The mean age and standard deviation were 48.9 ± 16.6 years. There

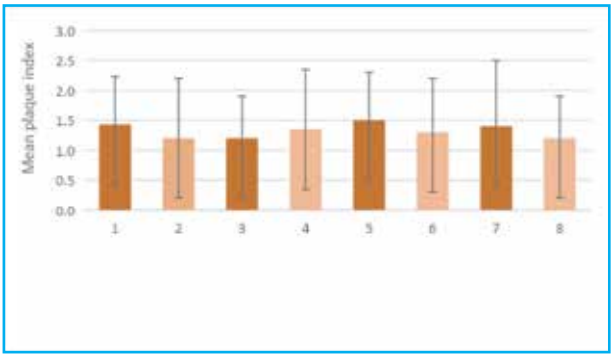


Figure 1: Silness-Löe plaque index (vertical bars represent standard deviation) according to sex, smoking status, diabetic status and presence of systemic disease.

was no statistically significant difference in mean age between males and females (49.5 ± 17.6 vs. 48.3 ± 15.7, respectively, p=0.324).

Sex

There was no statistical significance difference in plaque index or plaque percentage scores between the sexes as is depicted below (Figures 1 and 2). The mean value for the Silness-Löe plaque index was 1.4 ± 0.8 for males and 1.3 ± 1.0 for females (p = 0.241, Figure 1). Mean plaque percentage value for males was 52.9 ± 25.1% and 50.8 ± 25.3% for females (p=0.442, Figure 2).

A higher mean gingival index was observed for males (1.3 ± 0.6 mm) as compared to females (1.1 ± 0.4 mm, p=0.035, Figure 3). When bleeding on probing was evaluated as mean percentage, there was no statistically significant difference between males (54.5 ± 28.1%) and females (50.6 ± 25.5%, p=0.187, Figure 4).

Males presented higher mean probing depth than females (3.2 ± 0.8 mm vs. 3.0 ± 0.7 mm, respectively, p=0.003, Figure 5) and higher mean attachment loss (3.6 ± 1.0 mm) when compared to females (3.2 ± 1.1 mm, p<0.001, Figure 6). The mean number of missing teeth was not influenced by gender (7.9 ± 5.2 for males vs. 8.3 ± 6.1 for females, p=0.493. Figure 7).

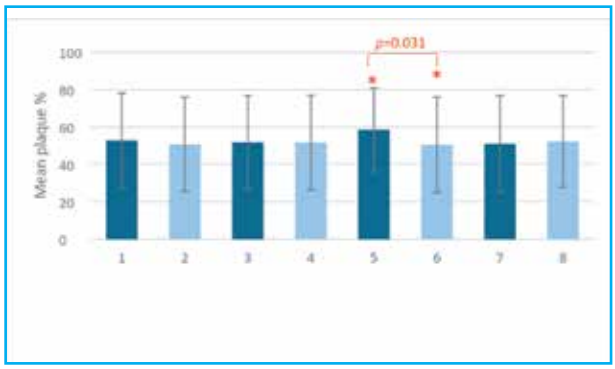


Figure 2: Mean plaque percentage (vertical bars represent standard deviation) according to sex, smoking status, diabetic status and presence of systemic disease.

***p=0.031 for comparison between diabetes and non-diabetes groups.**

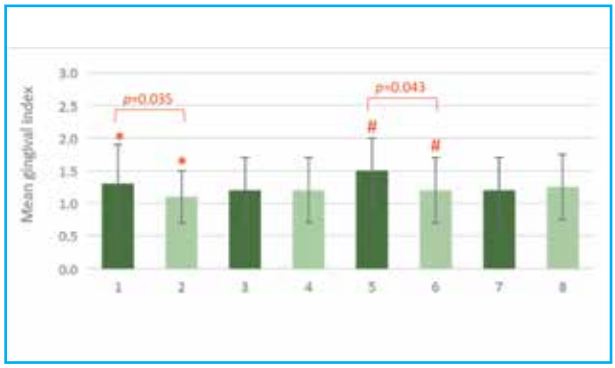
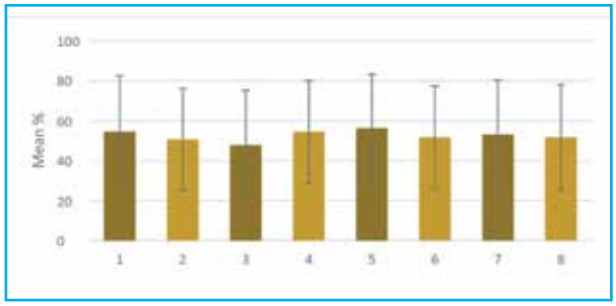


Figure 3: Löe-Silness gingival index (vertical bars represent standard deviation) according to sex, smoking status, diabetic status and presence of systemic disease.

***p=0.035 for comparison between males and females**
#p=0.043 for comparison between diabetes and non-diabetes groups.



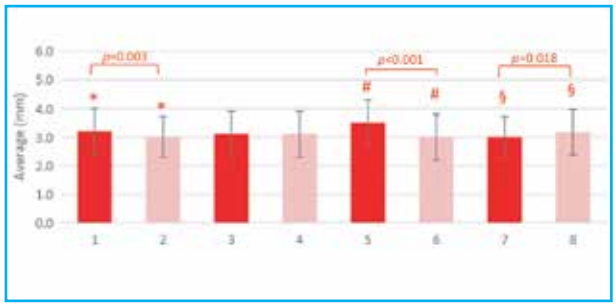


Figure 5: Mean probing depth (mm) (vertical bars represent standard deviation) according to sex, smoking status, diabetic status and presence of systemic disease.

***p=0.003 for comparison between males and females**
#p=<0.001 for comparison between diabetes and non-diabetes
§p=0.018 for comparison between groups with and without systemic disease

Smoking status

In total, 138 participants (30.7%) were smokers, while 312 were non-smokers (69.3%). For the smokers, 57.2% were males (n=79), and 42.8 were females (n=59). The prevalence of smoking was higher among males (38.7%) as compared to females (24.0%, p<0.001).

The presence of plaque was not influenced by smoking status when the Silness-Löe plaque index (1.3 ± 0.7 for smokers vs. 1.4 ± 1.0 for non-smokers, p = 0.620, Figure 1), nor mean plaque percentage (51.9 ± 25.0% for smokers vs. 51.7 ± 25.3% for non-smokers, p=0.949, Figure 2) were analysed.

Smokers presented lower mean bleeding percentages than non-smokers (47.7 ± 27.4% vs. 54.4 ± 25.7%, respectively, p=0.039, Figure 3). However, when the Silness-Löe gingival index was applied, smokers and non-smokers presented comparable indexes (1.2 ± 0.5 for both groups, p=0.935, Figure 4).

Mean probing depth (3.1 ± 0.8 mm for both groups, p = 0.983, Figure 5), mean attachment loss (3.4 ± 0.9 mm) for smokers vs. (3.4 ± 1.1 mm for non-smokers, p=0.459, Figure 6) and number of missing teeth (8.3 ± 5.4 for smokers vs. 8.0 ± 5.8) for non-smokers, p=0.623, Figure 7) were not influenced by smoking status.

Diabetes status

In total, 64 participants had diabetes (14.2%), of which 43 had diabetes combined with one or more systemic conditions (67.2%), and 21 had only diabetes (32.8%, Table 1).

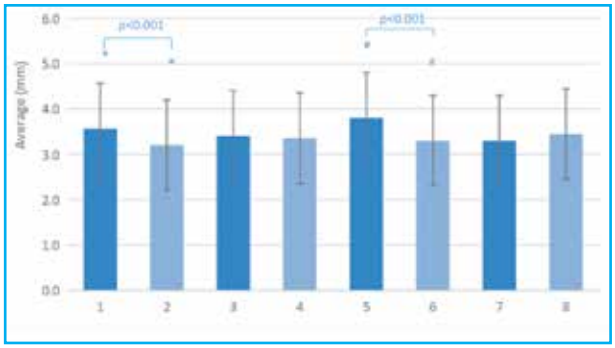


Figure 6: Mean attachment loss (mm) (vertical bars represent standard deviation) according to sex, smoking status, diabetic status and presence of systemic disease.

*p<0.001 for comparison between males and females
*p<0.001 for comparison diabetes and non-diabetes

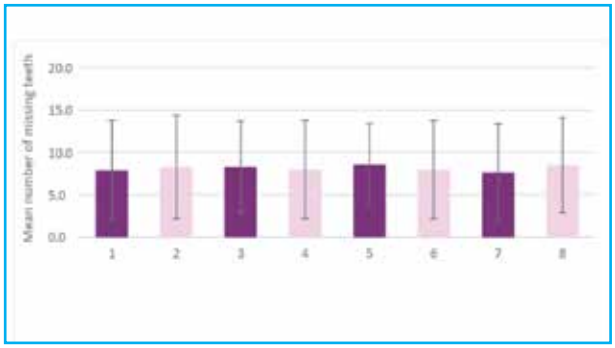


Figure 7: Mean number of missing teeth (vertical bars represent standard deviation) according to sex, smoking status, diabetic status and presence of systemic disease.

No difference was observed for the Silness-Löe plaque index, (1.3 ± 0.9 for non-diabetics vs. 1.5 ± 0.8 for diabetics, p=0.488, Figure 1). Mean plaque percentage was higher for patients with diabetes (58.6 ± 22.3%) when compared to non-diabetics (50.5 ± 25.5%, p=0.031, Figure 2).

Patients with diabetes presented marginally higher bleeding index according to the Löe & Silness gingival index (p=0.043, Figure 3). When gingival bleeding was analysed as mean percentage, it was not influenced by diabetes status, p=0.258 (Figure 4).

Higher mean probing depth was observed for the diabetes group (3.5 ± 0.8 mm) when compared to the non-diabetes group (3.0 ± 0.8 mm, p<0.001, Figure 5). Attachment loss was influenced by diabetes status, with non-diabetics presenting lower mean attachment loss (3.3 ± 0.9 mm) when compared to diabetics (3.8 ± 1.5, p<0.001, Figure 6). The number of missing teeth was not statistically different between diabetics (8.6 ± 4.8) and non-diabetics (8.0 ± 5.8, p=0.423, Figure 7).

Other systemic conditions

In the studied sample, 51.6% of the participants had other systemic diseases (n=232), from which 145 (62.5%) had one condition, 65 had two conditions (28%), and 21 had three or more conditions (9.5%, Table 2). Hypertension (n=42, 28.9%), diabetes (n=21, 14.5%), and HIV (n=14, 9.7%) were the most prevalent single conditions. In patients with two conditions, hypertension and altered cholesterol (n=15, 23.1%), diabetes and hypertension (n=15, 23.1%), and diabetes and altered cholesterol (n=4, 6.2%) were the most prevalent combinations. In patients with three or more conditions, diabetes, hypertension, and altered cholesterol was the most common combination (n=3, 13.6%).

There was no difference in plaque index (1.4 ± 1.1) for no disease vs. systemic disease groups (1.2 ± 0.7, p=0.338, Figure 1), nor in plaque percentage (51.1 ± 25.5% for no disease vs. 52.3 ± 24.6% for presence of systemic disease, p=0.654, Figure 2).

Gingival bleeding was not influenced by the presence of systemic disease, measured as gingival index (1.2 ± 0.5 for both groups, p=0.502, Figure 3) or bleeding percentage (53.0 ± 25.5% for no disease vs. 51.7 ± 26.2% for systemic disease, p=0.668, Figure 4).

Having a systemic disease was linked to higher mean probing depth (3.2 ± 0.8 mm) when compared to absence of systemic disease (3.0 ± 0.7 mm, p=0.018, Figure 5). Mean attachment loss was not influenced by systemic diseases (3.3 ± 1.0 mm for systemic diseases vs. 3.5 ± 1.1 mm for the group with no systemic disease,

Table 1. Prevalence of diabetes alone and combined with other conditions.

Diabetes status	N
Diabetes only	21
Diabetes + other conditions	43
DM2 - Anaemia	1
DM2 - Arthritis - Cholesterol - Hyperthyroidism	1
DM2 - Cholesterol	4
DM2 - Depression	1
DM2 - Heart condition	3
DM2 - HTN	15
DM2 - HTN - Arthritis - Cholesterol	1
DM2 - HTN - Arthritis - Gout	2
DM2 - HTN - Asthma	2
DM2 - HTN - Cholesterol	3
DM2 - HTN - Cholesterol - Osteoarthritis	1
DM2 - HTN - Epilepsy	1
DM2 - HTN - Heart condition - Cholesterol	1
DM2 - HTN - Kidney Failure	1
DM2 - HTN- Ehlers danlos syndrome	1
DM2 - HTN Heart condition	2
DM2 - Hyperthyroidism	1
DM2 - Prostate Cancer	1
DM2 - Thalassemia	1
Total	**64**

Table 2. Prevalence and description of one, two, and three or more systemic conditions.

One systemic condition	N	Two systemic conditions	N	Three or more systemic conditions	N
Hypertension	42	Hypertension - Cholesterol	15	Diabetes - Hypertension - Cholesterol	3
Diabetes	21	Diabetes - Hypertension	15	Diabetes - Hypertension - Arthritis - Gout	2
HIV	14	Diabetes - Cholesterol	4	Diabetes - Hypertension - Asthma	2
Arthritis - all types	8	Hypertension - Arthritis	3	Diabetes - Hypertension - Heart condition	2
Kidney problems	8	Diabetes - Heart condition	3	Asthma - Cholesterol - Active thyroid	1
Asthma	7	Hypertension - HIV	2	Hypertension - Gout - Heart Failure - Cholesterol	1
Mental problems	6	Hypertension - Anemia	2	Heart condition - Cholesterol - Prostate cancer	1
Cholesterol	6	Hypertension - Heart condition	2	Mental impairment - Eye problem - Kidney failure - Heart valve replacement	1
Heart condition	6	Hypertension - Thyroid disorder	2	Rheumatoid Arthritis - Prostate cancer - Heart bypass - Hyperthyroidism	1
Anemia	5	Heart condition - Asthma	1	Hypertension - Arthritis - Cholesterol - Osteoporosis - Hyperthyroidism - Collagenous colitis	1
Epilepsy	3	Hypertension - Gout	1	Diabetes - Hypertension - Arthritis - Cholesterol	1
Schizophrenia	3	Hypertension - Myasthenia gravis	1	Diabetes - Hypertension - Cholesterol - Osteoarthritis	1
Cancer	3	Hypertension - Arthritis	1	Diabetes - Hypertension - Epilepsy	1
Sinusitis	2	Hypertension- Asthma	1	Diabetes - Hypertension - Heart condition - Cholesterol	1
Thyroid disorder	3	Hypertension - kidney transplant	1	Diabetes - Hypertension - Kidney failure	1
Retinal necrosis	1	Hypertension - Asthma	1	Diabetes - Hypertension - Ehlers danlos syndrome	1
Cleidocranial dysplasia	1	Hypertension - Lupus erythematosus	1	Diabetes - Arthritis - Cholesterol - Hyperthyroidism	1
Eczema	1	Arthritis - Renal problem	1	**Total**	**22**
Myasthenia gravis	1	Cerebral palsy - Anemia	1		
Osteogenesis imperfecta	1	Kidney transplant - Bipolar disorder	1		
Papillon-Lefèvre syndrome	1	Osteoarthritis - Neuroendocrine cancer	1		
Rheumatic fever	1	Diabetes - Anemia	1		
Irritable bowel syndrome	1	Diabetes - Depression	1		
Total	**145**	Diabetes - Hyperthyroidism	1		
		Diabetes - Prostate Cancer	1		
		Diabetes - Thalassemia	1		
		Total	**65**		

p=0.146, Figure 6). The mean number of missing teeth was not statistically different for participants with systemic diseases (8.5 ± 5.6) as compared to those without (7.7 ± 5.7, p=0.098, Figure 7).

DISCUSSION

In the current study, sex, presence of diabetes, and other systemic diseases were associated with more clinical attachment loss. Males had a higher bleeding index, deeper pockets, and more attachment loss, compared to females. Deeper periodontal pockets were observed in patients with systemic diseases. In smokers, a lower bleeding percentage was observed. There was a higher plaque percentage, higher bleeding index, deeper pockets, and more attachment loss in diabetics. Results from this study provide valuable information given the general scarcity of data on the periodontal status of South African adults diagnosed with periodontitis.

Few South African studies report on the prevalence of periodontal disease.[25–27] In 1994, the Department of Health published the first National Oral Health Survey of South Africa, which included over 5200 participants from different racial backgrounds from all over the country. The prevalence of periodontitis in adults [35-44] years of age was 29.7%.[26] In the study from Chikte et al. (2019), a sample of 951 participants from mixed ethnic heritage living in the Bellville area in the Western Cape were evaluated for markers of periodontal disease. In total 68.3% of the sample had bleeding on probing, 56.7% had pocket depth 4 mm and above, and 40.2% had AL ≥ 4 mm.[25]

In a South African study on periodontitis characteristics in HIV patients, the control group (HIV negative, no systemic disease) presented average pocket depth of 3.2 mm, mean bleeding percentage of 50.3%, and mean plaque percentage of 75.2%. Average bleeding percentage and pocket depth are similar to the current results, however, plaque percentage was lower in the

present study.[28] In the current study, 6.9% of the group who presented with systemic conditions had HIV. Because patients are not compelled to disclose their HIV status, the prevalence of HIV in the current study is likely under-reported.

Similar to the findings from this study, Chikte et al. reported worse periodontal status in South African males, with a higher prevalence of periodontal pockets and attachment loss. However, only males with mixed heritage residing in the Bellville area were included.[25] In a systematic review including over 50.000 subjects from Shiau and Reynolds. (2010), there was an association between periodontitis and sex, with males having a 9% greater prevalence than females.[29] The higher risk for periodontitis in males has been reported irrespective of age, ethnicity, and geographic location. and attributed to biological dimorphism that manifest as differences in the immune system and dental plaque, as well as behavioural factors that influence daily oral hygiene habits and attendance of regular dental visits.[30]

In this study, two different methods were used to describe the presence of dental plaque and gingival bleeding, which are key markers for oral hygiene and gingival inflammation.[31] The Silness-Löe plaque index is a scoring system based on the thickness of plaque accumulation,[32] while plaque percentage score registers presence or absence of dental plaque. While non-diabetics had a lower plaque percentage than diabetics, no difference of statistical significance was detected for the Silness-Löe plaque index. Similarly, for gingival bleeding, the Löe-Silness gingival index based on a 0 to 3 score system,[32] and the bleeding percentage (presence or absence of gingival bleeding) were evaluated. When comparing smokers to non-smokers, the gingival index score was not statistically different, however, smokers presented with a lower bleeding percentage. Comparison between different indices is impractical, however, these results corroborate previous studies suggesting that scoring indices for plaque and gingival bleeding can be criticized given their high level of grading subjectivity and time-consuming nature.[33,34]

A strong body of evidence supports the association between diabetes and periodontitis.[35–37] Data from this study further support diabetes as a risk factor for periodontal disease, given the higher severity of clinical markers in the diabetes group. The worse periodontal status in the diabetes group could be partially explained by the higher plaque percentage.

Nevertheless, there was no statistical difference between diabetes and non-diabetes groups when dental plaque was evaluated through the Silness-Löe index. Rabede et al. (2009) explored the oral health of diabetes patients in South Africa. The study reported higher plaque index, increased prevalence of periodontitis, and worse oral health in the diabetes group compared to systemically healthy periodontitis patients.[38]
In a South African study from Matu et al. (2009), diabetes patients presented higher prevalence and severity of periodontitis as compared to non-diabetic patients, with no differences in plaque index.[39] The greater gravity of periodontitis in patients with diabetes have been attributed to the biological changes resulting from chronic hyperglycaemia and its complications, such as angiopathy, oxidative stress, inflammation, impaired wound healing amongst other conditions.[40]
There is also evidence on the connection between periodontal disease with other systemic conditions.[41]

In the present study, hypertension, diabetes, HIV, arthritis and kidney problems were the most prevalent single conditions in periodontitis patients. Despite the lack of data proving causality between periodontitis and these conditions, most studies suggest the potential for a two-way relationship, where systemic changes increase the risk for periodontal destruction and periodontitis increases the risk for metabolic and inflammatory changes.[42] The high prevalence of systemic disease in the studied sample highlights the importance of the correlation between oral and systemic health, indicating that the potential beneficial effects of periodontal treatment are not only confined to the oral cavity.[43]

Although the literature indicates that smoking increases the risk for periodontitis, the only statistically significant difference observed between non-smokers and smokers in the present study was lower gingival bleeding for the latter, mediated by the vasoconstriction caused by nicotine and other tobacco components.[44] It can be speculated that the lack of association between smoking and periodontitis in this study might be linked to the lack of information on smoking frequency, given that periodontitis risk in smokers is dose-dependent.[45] Other explanations include the potential exposure of non-smokers to passive smoking and the lack of distinction between former smokers and non-smokers.[25]

In the current study, the number of missing teeth was not affected by sex, smoking, diabetes, or other systemic diseases. This can be attributed to the high overall prevalence of tooth loss in the South African population due to the burden of caries and periodontitis, lack of access to preventive and restorative dental care, and cultural acceptance of tooth extraction as the definitive answer to dental problems.[46]

Detailed records on tobacco exposure would have been ideal. In addition, for future studies, diabetes should be characterized in terms of metabolic markers such as glycated haemoglobin given its impact on the development of complications.

CONCLUSIONS

Several local, systemic, and environmental factors can impact periodontal disease severity, progression, and response to treatment. In patients from a tertiary institution in the Western Cape, South Africa, worse periodontal conditions were observed in male patients and those with diabetes and other systemic diseases. In patients with diabetes, this could be at least partly explained by inadequate plaque control. Smoking was associated with lower gingival bleeding. Tooth loss was

not linked to sex, smoking, nor systemic diseases. Additional research is required to clarify the role of sex and systemic conditions as predisposing factors to periodontitis. Given the significance of periodontal disease for oral and general conditions and its multifactorial nature, it is crucial to explore risk factors that impact the etiopathogenesis of periodontitis.

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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Cervical Necrotizing Fasciitis: A case report

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ABSTRACT

Necrotizing fasciitis is a rare but rapidly progressive condition, with a high morbidity and mortality rate. This rapidly spreading soft tissue infection rarely occurs in the head and neck region, and when it does it is most caused by odontogenic origin. A variety of host factors such as immune status, hygienic practices and socio-economic status are role players in the disease process. This case report documents a 38-year old male who presented with cervical necrotizing fasciitis of odontogenic origin. The patient was managed and stabilized through removal of the necrotic tissue, extraction of all carious teeth, and optimization of the overall medical health status of the patient. HIV is widely prevalent in South Africa and therefore the patient consented to HIV testing, this alluded to an undiagnosed HIV positive status.

Uncontrolled HIV greatly suppresses the immune system and subsequently exacerbating the disease process thus its management is highlighted below. The patent is currently awaiting reconstructive plastic surgery which can only be addressed once his viral load is controlled. In the meantime, he has been educated on how to keep the wound clean and the importance of maintaining a healthy lifestyle, this includes HIV education and dietary information. Due to the poor prognosis often associated with necrotizing fasciitis, it requires early intervention, and a multidisciplinary approach is often needed.

INTRODUCTION

The earliest descriptions of necrotizing fasciitis date back to Hippocrates himself in 500 BC.[1] Necrotizing fasciitis is a rare polymicrobial soft tissue infection which rapidly progresses via haemotogenous spread, tracking along fascial planes. This infection occurs more frequently in the abdominal wall, perineum, and extremities; it is a rare find in the head and neck region. Its rapidly progressive nature is the greatest concern, resulting in a high mortality rate.[2-3] It mainly affects those of immunocompromised and low socioeconomical status.[2-6] According to the Joint United Nations Programme on HIV/AIDS (UNAIDS) it's estimated that 7 800 000 people in South Africa are living with Human Immunodeficiency Virus (HIV).[7]

Due to the high prevalence of HIV in this population, knowledge and swift intervention of this condition is of importance . 7 The microbiologic etiology distinguishes the four types of necrotizing fasciitis as explained in the table below by Miller et el.[4]

Type	Microorganism	Notes
I	Polymicrobial	• Mixed anaerobes and aerobes • Better prognosis • 70-90% of cases in head and neck region
II	Monomicrobial	• Most commonly streptococcus or staphylococcus • Most commonly seen in the limbs
III	Clostridium	• Gas Gangrene • Crepitis
IV	Fungal	• Most commonly candida • Most commonly seen in immunosup-pressed host • Aggressive with rapid extension

There is no clear consensus on the management of these cases however the literature does highlight a rough outline of management progression.[8] This includes early diagnosis through clinical examination and investigations such as appropriate X-rays, contrast enhanced computer tomography (CECT), microscopy culture and sensitivity (MC&S) and blood cultures. Culture guided antibiotic therapy directed by the investigations, removal of causative factors and aggressive surgical debridement of the affected area are sequential steps in the management of necrotizing fascitis.[9]

CASE

A 38-year-old coloured male with no known medical history presented to the Maxillofacial and Oral Surgery clinic at Pelonomi Tertiary Hospital in the Free State,

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with a seven-day history of necrotic tissue localized to the submental and submandibular regions.

Associated symptoms include dysphagia, odynophagia, and malaise. The patient's social history was negative for alcohol, smoking and illicit drug use. Vital signs were all in normal range. On extra-oral examination significant areas of necrotic tissue with suppuration were localized to the bilateral anterior triangles of the neck extending from the inferior border of the mandible to the hyoid bone anterior to the sternocleidomastoid muscle as shown above in Figure I and II. Intra-orally, there was trismus, multiple carious teeth and overall extremely poor oral hygiene.

Due to the extensive clinical presentation various blood tests were done to assess the overall health oof the patient. These results indicated an undiagnosed HIV positive patient with a viral load of 602 000 copies/ml and an absolute CD4 count of 25 L cells/ul. Subsequent testing for TB, Hepatitis B and C were negative.

Figure I and II: Clinical photograph showing the initial presentation before treatment

Orthopantomogram (Figure III) showed multiple carious teeth and root rests and early-stage osteomyelitis A contrast enhanced computer tomography (CECT) was taken of the head and neck to track the spread of the infection.

Figure III: Orthopantomogram (Figure III) showed multiple carious teeth and root rests and early-stage osteomyelitis

It showed:

- Submental soft tissue defect involving floor and anterior cervical triangle up to level of laryngeal cartilage;
- Platysmas, geniohyoid and digastric muscle necrosis;
- Mild periosteal reaction over inferior aspect of mandible with chronic mandibular osteomyelitis
- (dental origin);
- Hyoid bone and laryngeal cartilage were intact;
- Tongue base demonstrated early necrosis with no deep extension;
- Submental salivary glands are absent and
- Necrotic tissue debris over epiglottis, with preservation of epiglottic cartilage and hypothyroid cartilage

The report concluded that there was necrotizing fasciitis of the oral floor extending to hyoid bone with chronic dental origin mandibular osteomyelitis.

TREATMENT

The infected area was debrided under local anesthesia (Figure IV), a pus swab and tissue sample were obtained.

The MC&S of the pus swab and tissue sample showed numerous gram-positive bacilli and scanty gram-positive cocci and gram-negative bacilli. The bacterial culture produced a heavy growth of Citrobacter freundii (CITFR); this could be due to the prolonged exposure to broad spectrum antibiotics as the patient reported visiting the dentist and getting antibiotics for toothache. A moderate growth of Streptococcus anginosus (STRAN) and Streptococcus alpha-haemolytic (STRAH) was also demonstrated. The antibiotic sensitivity analysis showed resistance to ampicillin, amoxicillin, and amoxicillin – clavulanic acid. Therefore, once the cultures came back, his antibiotic regime was changed from Augmentin, Flagyl and Gentamycin to Ciprofloxacin.

Figure IV: shows affected area immediately after local debridement

A full dentectomy was done to remove the odontogenic cause of infection.

Internal medicine commenced treatment of the patient's HIV infection with Acriptega. This is an antiretroviral drug that contains Dolutegravir, Lamivudine and Tenofovir. The latest treatment guidelines advise that all patients newly diagnosed with HIV, be treated with a Dolutegravir based antiretroviral regime.[10]

Figure V: Affected area 3 days after debridement

Figure VI: Affected area 6 days after debridement

The affected area was cleaned twice a day with chlorhexidine and covered with gelonet, drawtex and wound dressings. The patient was monitored for 4 weeks.

Speech therapists and dieticians were consulted due to the patient having a communication between the intra-oral and extra-oral environment. The speech therapists conducted a swallow trail and noted that the patient had a poor pharyngeal – laryngeal transit and thus needed to be monitored. Accordingly, the dieticians opted for a liquid diet at first and then progressed to a soft diet to ensure nutritional sufficiency.

Figure VII: Affected area 3 weeks after debridement

Figure VIII: Affected area 4 weeks after debridement

Four weeks later (Figure VIII) , a biopsy was done and confirmed a microbial count of less than 1: 100 000. The patient was then referred to plastic surgery for closure of the affected area. Due to the patient being newly diagnosed with HIV, plastic surgery decided to wait until the patients CD4 count is at an acceptable level to prevent rejection of the tissue flap.

Figure IX: Affected area 2 months after debridement

DISCUSSION

According to Kaul et al, the global incidence of necrotizing fasciitis is 0.4 case per 100 000 population.[11] The largest study from a single health center in Nigeria reported that there is a definite rise in prevalence of necrotizing fasciitis as they have seen a gradual increase to around 4 cases a year.[6]

A systematic review conducted by Dhanasekana et al on necrotizing soft tissue infections from across the globe, found that the most common organisms involved are Staphylococcus aureus followed by Streptococcus pygenes and *E. coli* in North America, Asia, Middle East, and Africa. Interestingly, 16% of necrotizing soft tissue infections were accounted for by Methicillin-resistant Staphylococcus aureus.[12]

Trauma is the predominant aetiology of necrotizing fasciitis. Less common causes include odontogenic infections, tonsillitis, and nasal malignancies.[13]

Common clinical features include cellulitis and erythema, which results in the skin of the affected area becoming painful, necrotic and the patient developing a fever, sepsis or multi organ failure.[8] As the infection spreads via the fascial planes the skin will depict various stages of decomposition such as mottling, blistering or a rash. Microscopically, the tissue will show coagulative necrosis due to inadequate blood supply.[4] Goh et al concluded that characteristic features of patients with necrotizing fasciitis included disproportionate pain, failure of improvement to broad spectrum antibiotics and gas present in 24.8% of patients.[14]

Compromised immune systems due to diabetes, HIV and poor living conditions can exacerbate the spread of necrotizing fasciitis and make the patient more susceptible to developing it.[8] Thus, it is always important to examine the patient for common comorbidities. Patients with necrotizing fasciitis are likely to require a multidisciplinary treatment approach spanning across surgical, medical, diagnostic and allied health care disciplines.

CONCLUSION

In conclusion, early detection and rapid response with the removal of the local aetiology, culture guided antibiotic therapy and aggressive debridement are essential to patient outcome. Systematic diseases which contribute to disease susceptibility and progression, should be managed. Overall, a multidisciplinary team is required to successfully manage the patient.

Ethical Approval was granted by the University of Pretoria

The authors declare no conflict of interest and the above case report aligns itself with the declaration of Helsinki.

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

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1. Simulated and clinical aerosol spread in common periodontal aerosol-generating procedures (AGPs)

Particles, particularly aerosols, and splatter generated during routine dental procedures have been shown to have the potential to transmit the SARS-CoV-2 virus to patients. Thus, controlling the spread of aerosolized particles has become one of the core strategies for reducing occupationally acquired infections with the SARS-CoV-2 virus[1]. The World Health Organization (WHO) defines splatter as particles greater than 100 µm in size, droplets as particles between 5 and 100 µm in size, and aerosols as particles smaller than 5 µm. [1]

Dental procedures generate particles that are a mixture of saliva, blood, water coolant, plaque, gingival crevicular fluid, tooth hard tissue debris, calculus, and dental restorative materials that generate potential hazards to dental professionals.[1]The extent and spread pattern of common dental AGPs need to be identified before applying mitigating strategies.

Some prevention measures have been are proven to significantly reduce splatter or aerosol spread such as medium-volume suction (159 L/min), high volume suction (HVS) [>250 L/min] and mechanical extraction.

Puljich and colleagues (2022)1 reported on a study that sought assess the distribution of particles following common dental AGPs in an in vitro setting with and without HVS and determine the particles spread during non-surgical periodontal treatment for 19 patients using an ultrasonic scaler in a clinical setting.

MATERIALS AND METHODS

This study explored the generation and spread of particles created by dental AGPs in both simulated laboratory and clinical environments.

The Simulation study was carried out in a 25 m^2 room which had 7 air changes per hour and was located within a PC2 laboratory. A phantom head mannequin containing typodont teeth in both jaws was used. Mock dental procedures were performed on the mandibular right central incisor (tooth 41). Fluorescein sodium salt was added to the water coolant reservoirs of dental devices at a final concentration of 1 mg/mL (approximately 3.0 mMol/L) as a tracer dye to track particle travel. To prevent bias, one periodontist trainee performed all the simulated and clinical experiments.

The following dental devices were used for the mock periodontal AGPs:

- An ultrasonic piezoelectric scaler (EMS Piezon) was used at intensity setting 10 and water flow rate at 48 mL/min, with a scaler tip of type PS. For the experimental protocol, the scaler tip was positioned adjacent to the lingual surface of tooth 41.
- An air polisher device (EMS Air Flow Prophylaxis Master), was used at an air pressure setting of 3 (1.9 Bar), with a water flow setting of 70% at 53 mL/min. The abrasive particles were 14-µm erythritol powder. The tip of the air-polishing device was located 3–5 mm from the buccal aspect of tooth 41, at an angle of approximately 45 degrees, with the spray aimed towards the incisal edge.
- A 2.2-mm diameter dental implant osteotomy drill (Straumann) was used in a 20:1 reduction handpiece at 200 revolutions per minute. The water coolant flow rate was 100 mL/min. For this experiment, tooth 41 was removed from the typodont model and the implant drill was placed at 2 mm along the imaginary line joining the incisal edges of the 31 and 42 teeth.

Each device was tested without suction to establish baseline data and then once again using intra-oral high-volume evacuation (Aspi-Jet 6) with an airflow of approximately 325 L/min. The suction used was comparable to HVS used in the clinical setting. The evacuation tip was held approximately 10 mm from tooth 41, favouring the left side of the mannequin. For the ultrasonic handpiece, the procedure was carried out for 10 min, while the air-polishing and implant surgical drill procedures lasted 2 min each to mimic a real clinical scenario. For the air-polishing device, the suction tip was placed adjacent to the point on the tooth where the powder made contact. Each AGP was

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repeated 10 times for each scenario (without or with HVS). Before each procedure, pieces of filter paper measuring approximately 150 mm × 150 mm were placed in five different locations around the phantom head. Location 1 represented the dentist's position located 20 cm away from the center of the mouth in the longitudinal plane. Location 2 was located 15 cm away from the mouth, at a 90° angle to the left, to mimic a dental assistant. Location 3 was 22 cm in front of the mouth mimicking the patient's chest, while location 4 was mimicking a location further along the patient body at 60 cm away from the mouth. Location 5 was mimicking a distant site away from the procedure 120 cm away from the center of the mouth on the left side of the patient at a 60° angle. Immediately after each cycle, the filter paper was imaged for splatter, droplets, and aerosols. The filter paper locations were cleaned thoroughly at the end of each testing run, and a minimum waiting period of 30 min used between testing cycles to prevent residual effects of airborne contamination.

The five locations of the filter paper strips were used to collect in vitro splatter, droplets, and aerosols in a laboratory setting with and without HVS. Location 1 reflects the dentist's upper chest and face mask, location 2 reflects the dental assistants' forearms and body, location 3 represents the upper portion of the patient's chest, location 4 represents the patient's body, location 5 represents the dental chair/suction unit.

Filter paper sheets were scanned using a fluorescence imaging system. Images were analyzed using Fiji-ImageJ software to determine the diameter of the tracer particles.

For the clinical component of the study, a total of 19 patients attending the postgraduate specialist periodontal clinic were invited to participate in the study. Written consent was obtained from the participants with the following inclusion criteria:

1. ≥ 18 years old;
2. able to provide consent for enrolment in the study;
3. self-reported stable general systemic health;
4. ≥ 20 teeth (excluding third molars);
5. patients requiring supragingival debridement with an ultrasonic scaler.

Exclusion criteria were (1) immunosuppression; (2) antibiotic therapy within the proceeding three months; (3) uncontrolled medical conditions; and (4) long-term use of anti-inflammatory medications.

The study was performed by one periodontist trainee in three dental operatories each measuring approximately 15 m^2 with 7 air changes per hour. Each room had delivery air outlets and return air collection on the ceiling. Prior to each patient appointment, all hard surfaces on the dental chair and throughout the operatory were cleaned as part of standard infection control procedures.

Approximately 1 mL of unstimulated whole saliva was collected at the beginning of the appointment by asking the patients to expectorate pooled resting saliva into a sterile Falcon tube. Following the Australian Dental Association guidelines for the COVID-19 pandemic, pre-procedure mouth rinse and high-volume suction were applied to all visiting dental patients. Fifteen millilitres of hydrogen peroxide 1.5% w/v (Colgate Peroxyl) was used for each patient to rinse for 30 s prior to the ultrasonic scaling. Aerosols, droplets, and splatter generated during the ultrasonic scaling were collected on pieces of filter paper that were placed at nine locations: Two on the patient protective sheet, either side of the midline in the upper chest area; Two on the dentist, on either side of the midline in the upper chest area; Two on the dental assistant, on either side of the midline in the upper chest area;

One on the dental bracket tray table attached to the dental chair; One on the suction unit of the dental chair; One on the bench, approximately 1.5 m to the right of the patient; Negative control (NC): one filter paper was not exposed during the appointment and acted as a negative control. Thus, each patient has their own NC as a background to compare; and Whole saliva from each patient was used as a positive control.

Each patient underwent supragingival ultrasonic scaling for 10 min using the piezoelectric scaler built into the dental unit. The scaler was operated on a power setting of 9 with 80 mL/min of water flow rate, using a fine ultrasonic scaler tip.

After this time, the filter paper strips were collected using fresh gloves and placed into tubes. Within 10 min, the strips were placed in a – 80°C freezer located in an adjacent PC2/BSL2 laboratory and then kept frozen. At the end of the clinical procedure, hard surfaces on the dental chair and throughout the operatory were again decontaminated using standard infection control procedures. There was a minimum of 60 min between patient appointments, which allowed for 7 air changes in the room. The dental team donned new protective gowns, masks, and gloves for each patient.

The protein content of each filter paper was determined from samples incubated at 37°C for 30 min with the test reagent. There were two aspects of data analysis: (a) bioaerosol contamination at each location for each patient was estimated based upon the protein quantity at that location and the protein concentration of the patients' original whole saliva sample; (b) the values higher than their NC background were considered to represent contamination.

RESULTS

In vitro simulated splatter generation with and without HVS
During 10 min of using the ultrasonic scaler on a mandibular incisor tooth, HVS reduced splatter particles for all three types of devices. Locations 2 and, to a lesser extent 1 were the most spread sites for all three equipment types. The 2-min air polisher generated more splatter particles compared to a 10-min ultrasonic scaler procedure, while the 2-min implant drill led to the least splatter liquid particles. The number of particle numbers was quantified by measuring the percentage of the total area of each filter paper. HVS reduced the extent of spread for all three dental AGPs. The distribution of particle size at the five locations exhibited median values larger than 200 µm, consistent with splatter spread (large droplets). Particle numbers and distributions were measured for each location. A significant benefit for the use of HVS was seen with all devices at location 2, as well as for the ultrasonic scaler at location 4. Particle histogram patterns at all five locations demonstrated that HVS did not alter the median size of splatter particles.

Aerosol and droplet particles at 120 cm away from the source with and without HVS – in vitro

The aerosols and droplets that were retained on filter paper fibers were captured at 120 cm from the source (location 5) after 10 min of the ultrasonic scaler and 2 min of air polisher and implant drill (Fig. 4a). Small particles (0.7 to 100 µm in diameter) were detected, whether or not HVS was used, indicating a mixture of aerosols and droplets (Fig. 4b). The ultrasonic scaler produced the highest number of particles that were 5 µm in median diameter or less. The use of HVS reduced particle quantity for all three devices.

Analysis of the average particle count and the percentage coverage of the total area for a mixture of aerosol and droplets revealed that HVS significantly reduced 82.6% and 93.8% of small particles at location 5 for both the ultrasonic scaler and the air polisher. The same was found for a separate analysis of aerosol and droplet particles.

Taken together, the in vitro simulated studies demonstrated that the air polisher generated most splatter particles and the use of HVS significantly reduced the spread of splatter, droplets, and aerosols for ultrasonic scaler and air polisher.

Bioaerosol contamination in a clinical setting during routine periodontal supragingival scaling

Whether bioaerosol spread can generate hazards to dental health professionals in a clinical setting was examined. A total of 19 patients (1 healthy – BOP < 10%; 3 gingivitis - BOP > 10 % and 15 periodontitis – 2 × stage 1, 10 × stage 3, 3× stage 4) requiring supragingival calculus removal as part of their dental care were recruited, thus generating a total of 190 clinical (filter paper) samples and 19 saliva samples.

The clinical study included 9 females and 10 males, aged 63.3 ± 13.2 years old (ranging from 35 to 80 years old) with one smoker. The average PPD for all patients ranged from 2.34 to 3.27 mm, with an average of BOP of 18% ± 12.2% (ranging from 4 to 44%) and PI of 22.9% ± 11.3 % (ranging from 2 to 42%). For periodontitis patients, 2.42 ± 3.06 sites had a deep periodontal pocket that is ≥ 5 mm (ranging from 0 to 13).

Samples were eluted from filter paper strips placed at 9 different locations. Compared to each patient's background (NC filter paper), protein quantification at each location showed that only 10.5–21.1% of patients generated bioaerosol protein contamination beyond the relevant negative control sample for each patient. The extent of protein contamination at each location varied between patients and was not influenced by periodontal health status.

CONCLUSIONS

The in vitro simulated component of the study showed that the air polisher produced the largest amount of splatter particles, while the ultrasonic scaler generated the largest amount of aerosol and droplet particles at 1.2 m away from the source. The use of HVS reduced up to 96 % of splatters and 93% of aerosol and droplets spread. Additionally, supragingival ultrasonic scaling did not produce significant amounts of bioaerosol contamination in the majority of clinical cases.

Implications for practice

the importance of using HVS during AGPs was highlighted by the results of this study

REFERENCE

1. Simulated and clinical aerosol spread in common periodontal aerosol-generating procedures

2. Influence of radiotherapy on dental implants placed in individuals before they were diagnosed with head and neck cancer

More than 700 000 people are diagnosed with Head and neck cancer (HNC) every year[1]. Common modes of treatment include surgery, radiotherapy (RT) and chemotherapy which is used alone, in combination or concurrently. Both surgery and RT have side effects that often result in changes in the anatomy of the oral and maxillofacial region, which makes it difficult to repair dentition defects or to substitute missing teeth using conventional restorations. To further complicate this problem, most HNC patients require dental restoration replacement due to tumor resection or tooth extraction prior to radiation therapy1. Importantly, dental implants and prosthetic restorations are an effective way to rehabilitate teeth defects and missing dentition, and these interventions can substantially improve oral health and the quality of life of HNC patients. [1]

Published studies of dental implants placed in irradiated bone have reported success rates as high as 100% success after 1–5 years of placement. However little is currently known about the influence of radiation on dental implants placed before HNC diagnosis.

Modern radiotherapy techniques can treat the individual target volume with a high conformal dose distribution and a steep dosage gradient, which means the radiation dose varies substantially across organs and tissues of interest. [1] Li and colleagues from China (2022)1 reported on a study that sought to investigate the influence of implant-bed-specific radiation dose on dental implants and to evaluate the impact of these implants on radiation dosimetry among patients who had dental implants and were later diagnosed with HNC.

MATERIALS AND METHODS

A retrospective study was conducted with 8931 patients who had received radiation therapy (RT) over the previous 10 years between 2011 and 2020. Patients who had dental implants and who had radiotherapy at the study hospital in China between January 2011 and December 2020 were included. Patients who had dental implants placed after the radiotherapy treatments were excluded.

Information collected included demographic variables (sex, age) and health status (tumor location, tumor site dose, and chemotherapy treatment). Implant information per patient included the total number of implants and the implant site.

To accurately evaluate the implant-bed-specific irradiation doses for each implant, the researchers used the treatment planning systems Monaco® and ARIA® to import and register each scan. In all patients, the contouring and planning details, including radiotherapy, fractionation, total dose, oral cavity dose, mandible dose, and parotid doses, were retrospectively reviewed.

The implant-bed dose was estimated by (1) contouring 58 available 3-dimensional radiation plans and (2) subsequently verifying the implant-bed by imaging until an exact match was found for each particular implant. In this way, an implant-specific radiation dose for 58 patients with 151 implants was recorded. Patients with no implants matching tumor site and stage served as a control group (n = 58). The radiation hot spots, the cavity dose, mandible dose, and parotid doses were assessed.

In all cases, the marginal bone status was evaluated using CT images taken 3–4 weeks before RT (baseline) and 1 and 3 years after RT. Acquisition CT data were acquired on GE Discovery CT scanners. The first step was to superimpose two different CT images taken at different time points using a digital gauge to ensure the same site was evaluated. Specifically, the researchers superimposed baseline images and 1-year images after RT to test the marginal bone status 1 year after RT; similar steps were used to test the marginal bone status 3 years after RT. By measuring the distance from the bottom of the implant to the most apical point of contact with the implant, they measured the marginal bone levels at the mesially, distally, buccally, and lingually. Bone level changes were calculated by subtracting the 1-and 3-year marginal bone values from the initial after RT value. This was done separately for mesial and distal sites. Radiological implant success was also assessed.

RESULTS

A total of 8931 HNC patients received RT between 2011 and 2020. Of these, 1865 patients received dental restorations (20.9%) before RT, of which 66 cases (3.5%) were implant restorations.

This study comprised 58 irradiated HNC patients (38 male and 20 females; median age 59 years, range 53–68 years) who had received dental implants prior to RT, including 72 (47.7%) and 79 (52.3%) implants located in the upper and lower jaws, respectively, as well as 79 (52.3%) and 72 (47.7%) implants located in the anterior and posterior jaws.

All patients had completed radiotherapy with a median dose of 62.4 Gy (range 62.2–67.7 Gy), 4 of which as definitive (6.9%) and 54 as adjuvant (93.1%). A total of 9 patients (15.5%) received chemotherapy in addition to radiotherapy. In addition, 16 (27.6%) patients received modulating radiation techniques IMRT and 42 (72.4%) received VMAT. `The researchers were able to measure the exact irradiation dose of the implant bed in 58 patients with 151 implants. There were differences in implant-bed-specific doses as a function of implantation site. The median radiation dose was 40.3 Gy, ranging from 30.7 to 49.7 Gy. Implants inserted anteriorly in the oral cavity received a cumulative mean dose of 35.7 Gy, which was significantly lower than the estimated 45.3 Gy of the posterior oral cavity region ($P < 0.001$). Implants inserted in the maxilla received a cumulative median dose of 35.0 Gy compared to the 45.9 Gy of those inserted in the mandible ($P < 0.05$). All implants were inserted into the native jawbone, and no patients developed osteoradionecrosis following radiotherapy.

Furthermore, the median hot spot was also similar in the two groups, with 112.5% (62.4 Gy) observed in the implant group versus 112.3% (63.1 Gy) in the control (i.e., non-implant) group. For patients with dental implants, the median oral cavity dose was 38.2 Gy, which is slightly higher than the 36.2 Gy measured in the non-implant control group. Similarly, the radiation dose in the mandible and parotid, in both the implant group, (45.6 Gy and 25.8 Gy, respectively) and the non-implant group (47.6 Gy and 24.2 Gy, respectively) were not significantly different.

The survival rates across the 151 implants following radiotherapy were 99.94% and 97.4% after 1 and 3 years, respectively. In terms of peri-implant bone resorption, the median marginal bone losses after 1 and 3 years respectively, 0.3 were 8 mm and 1.14 mm mesial side, 0.43 mm and 1.14 mm distal side, 0.17 mm and 1.20 mm buccal side, and 0.29 mm and 0.35 mm lingual side.

CONCLUSIONS

The researchers concluded that Implant-bed-specific dosage significantly differs depending on primary tumor location, and more than 40 Gy seems to be a risk factor for peri-implant bone resorption, In addition, implants did not affect the radiation dosimetry in this study indicating that radiation oncologists did not need to worry about the impact of implants on radiotherapy.

Implications for practice

The results of this study further illustrate that dialogue between dentists and radiation oncologists could contribute to the long-term success of implant restorations in HNC patients.

REFERENCE

1. Influence of radiotherapy on dental implants placed in individuals before diagnosed with head and neck cancer: focus on implant-bed-specific radiation dosage

CPD questionnaire on page 564

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

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Trust me – I'm a Doctor

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ABSTRACT

A professional has a job that needs a high level of education and training, and who acts in a manner that conforms to the technical and ethical standards of their profession. They are also expected to adhere to a specific set of duties known as professional ethics and competencies.

Many duties are common to most professions such as honesty, integrity, transparency, accountability, objectivity, respectfulness and obedience to the law. In medicine and dentistry there are additional duties related to all aspects of patient care and workplace interactions. In this paper the duties of a doctor will be discussed under the categories of legal duties, business-related duties, professional duties, clinical duties, educational duties, the duty to work, and moral / ethical duties.

While it is recognised that practitioners have a right to practice their trade as a result of their professional education and training, they are also obligated to behave in a manner that will uphold the reputation of their discipline. At the same time, patients have the right to expect and to receive the best possible care but need to also take care of their own health and follow the advice given to them by their doctors.

INTRODUCTION

A professional has been defined as a person who has the type of job that needs a high level of education and training[1], and who acts in a manner that conforms to the technical and ethical standards of their profession[2]. Professional responsibility refers to the "set of duties within the concept of professional ethics"[3]. They are drafted for those who are required to "make judgments, apply their unique skills, reach informed decisions for, or on behalf of others, and to exercise due care and responsibility when acting in their areas of specialization[4]. It "encompasses an array of personal, corporate, and humanitarian standards of behavior, as expected by clients, fellow professionals, and professional bodies"[5]. These standards are usually structured into guiding documents, commonly known as the "code of ethics". The purpose of which are to establish a general blueprint of the expected ethical standards that will assist professionals and organizations in implementing and governing the ideals of the profession[6]. Although intended for use by professionals when they are engaged in applying their unique skills in their career, the same ethical and professional principles should also be applied in matters relating to their individual character, demeanor, and personal life[4].

They may also help persons decide on how to act in different situations, by directing them to debate options using ethical perspectives that encompass their academic training, clinical experience and judgement, as well as "virtues, values, rules, ethical theories, moral stances, moral decisions and moral compasses" [7].

There are certain generic responsibilities that can be applied to almost all professions these include:

- Honesty - being trustworthy, loyal, sincere, and fair
- Integrity - showing consistency between actions, values, expectations, and outcomes
- Transparency - operating in a manner that allows others to see what actions are performed
- Accountability - taking responsibility for actions and their outcomes
- Objectivity - having a well-informed unbiased view on practical matters
- Respectfulness - treating colleagues and clients with care and compassion
- Obedience to the law – adhering to regulatory and governmental guidelines[7]

In addition to these, in medicine and dentistry, there are other competencies and duties related to the ethical, legal and clinical aspects of patient care as well as workplace principles that inform on matters related to, amongst others, interactions with staff, colleagues, peers, company representatives and third-party funders.

Duties of a Doctor

Medical and dental students undergo many years of structured academic study and clinical skills development before being awarded the title of "Doctor". This designation gives them the right to practice their profession, and brings with it a certain amount of public honour, respect and trust. However, in order to live up to this reputation, they need to be aware that their rights as a professional carry with them certain responsibilities and obligations.

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These can be considered "Doctor's Duties". While these duties cannot make demands in matters of taste, personal preferences, personal choices and personal lives, they do apply to all matters affecting the common good of society[8]. Professional duties can fall into a number of different categories including: legal, professional, clinical, educational (self-improvement and education of others), moral / ethical, business-related conduct, and duty to work[8]. Many of these core values and duties fall into more than one category, but will only be discussed once.

Legal Duties

Core values and responsibilities relate to Confidentiality, Competence, Honesty and Professional Courtesy.

Legal duties compel professionals to know and adhere to the laws of the land as well as the specific laws stipulated by their professional governing bodies. Ignorance of the law can never be used as a justifiable or defensible argument for non-compliance or misdemeanours[9]. Confidentiality revolves around the special doctor: patient relationship, wherein anything discussed or revealed during a consultation should not be disclosed to any third party.

There is however, a legal over-rider that permits the doctor to breach confidentiality if they believe that their silence may put the patient, themselves, another person or the community in danger of harm, or when compelled to do so by a court of law[10]. When considering competence, the clinician should only carry out work they have been trained to do, providing they are also skilled enough to do so. Furthermore, it requires them to engage in a process of continuous and honest self-assessment and reflection. If they suspect or detect any personal mental, physical or emotional deterioration, they are ethically obliged to adjust their scope of work or even stop practicing altogether[11]. This may be on a temporary or more permanent basis. Honesty relates to their duty to do what is in the best interest of their patients at all times. It covers the ethical issues of patient education, autonomy and informed consent and will be discussed later.

It also refers to honesty with regards to finances. For example, they may only bill for services provided, fees should be in accordance with those suggested in the government gazettes, unless they can justify why they deserve more, and should submit legitimate claims to third party funders. They must also maintain accurate and comprehensive records, be honest when issuing sick certificates and writing out prescriptions, and avoid all forms of legal misconduct[12].

Business-related Duties

Core values and responsibilities- Integrity, Teamwork, Objectivity, Honesty

While medicine and dentistry may be professional vocations, they are also the clinicians' livelihood and as such may be considered as businesses as well. Thus, all of the codes of conduct related to running a business will apply to running a practice. Many clinicians work for themselves, meaning that they will not have to answer to a higher manager, or have a superior watching over them. This could make it easy and tempting for them to act in a manner that will primarily benefit their own pockets. Personal integrity and conscience are arguably the most central qualities that will determine how they chose to conduct their business. Honest practice covers so many diverse issues, such as:

- the hiring of adequately trained staff;
- paying fair wages;
- not expecting employees to work unreasonable hours (unless they agree and are compensated for this);
- providing patients with the necessary and most appropriate treatment;
- avoiding the temptation to over-service;
- correct billing and handling of finances;
- avoiding split-billing, medical aid abuse or medical aid fraud;
- using integrity and good judgement when writing up prescriptions and issuing sick letters;
- not succumbing to perverse incentives offered by manufacturers and supply companies;
- and avoiding any form of conflict of interest to name just a few[12].

Ultimately personal character is what will determine how a person behaves when nobody is watching.

Professional Duties

Core values and responsibilities - *Professional Courtesy, Competence, Awareness of limitations, Practicing within scope of training, Expertise and Professional qualification, Legal advertising and justifiable self-promotion*

Professional courtesy relates to how clinicians interact with their peers, their patients, and the public. It is generally more of an ethical than legal duty, but may fall into the latter category if they publicly slander or malign the reputation of a colleague. However, if they do detect any form of impropriety or incompetence in one of their peers, they should be brave and honest enough to first approach that person and offer help or remediation (this is ethically desirable). If collegial discussions do not elicit any change in behaviour they are obliged to report the misconduct[13]. They need to also be aware of the manner in which they address others, and strive to treat all patients as equal. (Competence, Awareness of limitations, Practicing within scope of training, Expertise and Professional qualification are all discussed in clinical duties below).

With the explosion of social media access, many clinicians have also taken to this platform to post practice-related material. This could have been an ideal avenue for the profession to promote oral health and educate the public, but has unfortunately become more of a channel for self-promotion, or worse, dissemination of mis-information. An increasing number of dentists are posting "before and after" photographs of their work and offering to provide similar spectacular make-overs to others.

This is tantamount to advertising, a practice that has always been frowned upon amongst medical professionals. It is concerning to note that these posts not only create unrealistic and at times false expectations

amongst the public, but also seldom elaborate on the practical issues of costs, and the potential biological and socio-economic risks associated with the procedures. Neither do they provide adequate details on maintenance requirements, and possible complications. Very few (if any) show long term follow-ups[14-16].

There are even sites where practitioners offer special deals such as "family discounts", "early bird promotions", "bring a friend and get two for the price of one offers" or "special wedding packages". Almost all of these procedures are purely cosmetic in nature with no justifiable clinical need or indication for the intervention.

A more disturbing observation is the increasing number of dentists who are offering services outside the scope of practice, beyond their levels of training and expertise or even outside of the profession altogether. There are general dentists offering full mouth make-overs in a few short visits (even same day service), yet prosthodontists may take weeks or months to complete the same treatment, especially when it involves major changes, in patients with complex parafunctional habits, in those needing multidisciplinary treatment planning and work, or cases where there will be adjustments in vertical dimensions and occlusal schemes.

There are also sites that make claims of therapeutic benefits that have no scientific backing, and where treatment could even do more harm than good. Two recent examples include a dentist who claims that skew teeth need to be straightened because "overlapping teeth trap more food and cause more cavities; your speech will be more fluent and clear with straight teeth; eating tough meat like steak will be easier; crooked teeth are prone to break easier; you get fewer headaches with straight teeth; your gums will be healthier; your overall health will improve; you will need less expensive dental treatment later in life; and of course, you will have a better self-esteem".

The second site offers to provide "slimming wires as a weight loss method". In essence they put orthodontic bands on all the teeth and then wire the jaws shut. What about oral hygiene? Potential tooth damage? Psychosocial implications? Cost and time duration? How will this address and improve long term eating habits? Where is the scientific evidence and proof that this treatment modality works? And what to do in the event that the patient chokes, aspirates an object or regurgitates? Such practices amongst our colleagues cannot be condoned and need to be challenged[17].

Finally, when considering the ease with which the public can access and share posts from Internet sites, it is important for clinicians to be careful of the image they portray. Private chats and personal groups are seldom exclusive, and one ill-advised comment can easily be taken out of context and spread widely. They need to be aware that any actions or words spoken in their private lives can so easily end up affecting their professional life and reputation as well[17].

Clinical Duties

Core values and responsibilities – *Trust, Do No Harm, Privacy, Competence and awareness of limitations, Practicing within scope of training, expertise and professional qualification, Avoiding improper relations with patients (in person and on social media sites), Social accountability and Provision of appropriate treatment*

Clinical duties are primarily patient related and fundamentally based on the doctrine of "first do no harm" as outlined in the Hippocratic oath[18]. These cover a range of issues such as communication, confidentiality, the patient's right to high quality of care, provision of the most appropriate treatment, completeness of work, professional courtesy, trust and honesty, beneficence, non-maleficence, respect for patient's autonomy, awareness of personal limitations and scope of expertise, and the insight and ability to know when to refer a patient for a second opinion or to a more skilled clinician[19-24].

From a practical perspective they relate to the physical oral environment and adherence to the laws of mechanics, physics and biology. They cover all aspects of the actual work carried out in the surgery as part of the patient's definitive treatment.

Educational Duties

Core values and responsibilities- *Consideration, Growth, Communication, Continued professional development, Patient consideration, Patient education*

Educational duties fall into two main categories, the first relates to continual self-improvement and life-long learning, while the second refers to the duty to educate the public. In the former, clinicians are expected to keep up to date with current literature, techniques, materials and trends, and to adapt their practices if and when it becomes necessary. In an attempt to try and enforce this, the HPCSA implemented compulsory Continual Professional Development (CPD) requirements. While it is a legal requirement for practitioners to earn CPD point on a yearly basis in order to be allowed to practice, one hopes that they also have the moral compass to not just treat this as a necessary evil, but to see it as the valuable learning and self-improvement tool that is set out to be[25, 26].

It also relates to the altruistic aspects of being a professional such as providing education and preventive services to the public, and sharing of knowledge and skills with colleagues through responsible communication in workshops, CPD events, chat groups and via research and publications[7, 27].

Duty to work

Core values and responsibilities- *Duty to self and Society, Integrity, Teamwork.*

We all need to work in order to earn a living and survive financially. However the duty to work has many more practical and philosophical layers. Being able to work and generate an income provides one with a sense of dignity, it can be a form of self- expression and creativity, and it may be transformative in that it could help others, could add to technological progress or may serve to change

(hopefully improve) the environment. At the same time, education is a privilege. Having spent time and money on gaining a degree, one is ethically obliged to give back to society by working in the profession of one's training. In medicine and dentistry this entails treating patients who are in pain, who have infections, who are ill / in need of therapy, or who seek some medical intervention to improve their physical or psychosocial well-being and state of health.

It would be ethically pleasing if clinicians, in addition to performing their core profession of being doctors, could include an altruistic element into their work, where-in they "give back" to society. This may be by providing voluntary services, taking part in outreach programmes, helping with community up-liftment projects, providing public screening and education, or by contributing to any number of other similar societal programmes. Finally, for those who believe in any form of higher power, work allows them to honor their creator by using their talents to their fullest.

Moral / Ethical Duties

Almost all of the aforementioned core values and responsibilities are also ethical duties, along with many others. Ethical duties encompass Confidentiality, Competence, Professional Courtesy, Trust, Non-maleficence, Privacy, Integrity, Respect for patients and peers, Consideration, Communication, Obligation of continual self- development, Self-reflection, Beneficence, Respect for the patients' rights to autonomy, Social accountability and Community engagement and service

CONCLUSION

Medical and dental practitioners have a right to practice their trade as a result of their professional education and training. With this right comes a duty for them to behave in a manner that will uphold the reputation of their discipline, and to live up to the respect and trust that their patients and society have bestowed on them. Their patients in turn, have the right to expect and to receive the best possible care from their treating doctors. However, they too have certain duties, such as to take care of their own health and oral hygiene status, and to follow the advice given to them by their doctors. Both parties need to fulfil their specific duties related to their respective rights in order to build and maintain a just and stable society.

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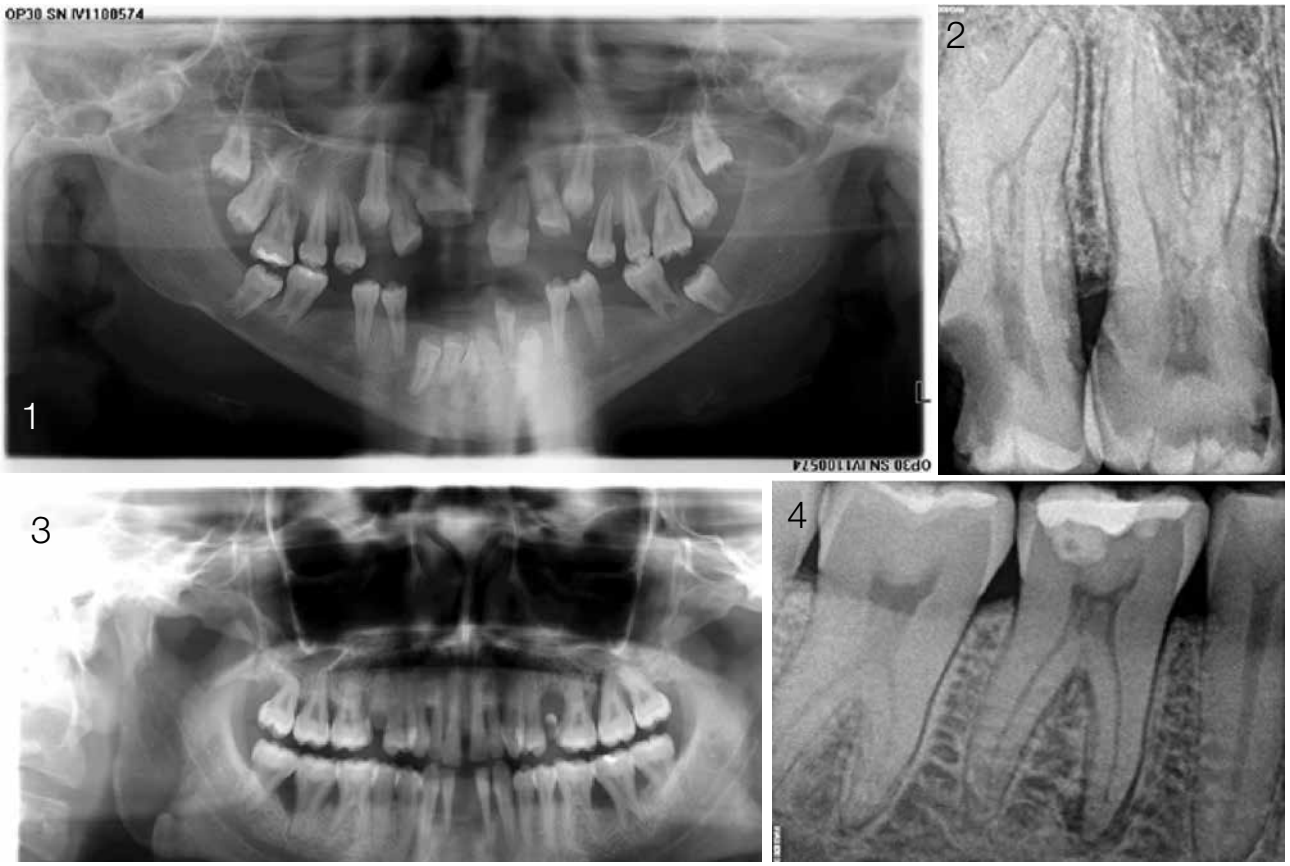
Maxillofacial Radiology 204

SADJ October 2022, Vol. 77 No.9 p574 - p575

Z Yakoob[1]

CASE

Below are four patients that presented to our facility for dental treatment. In all four patients, Taurodontism of varying degrees was noted as incidental findings.



INTERPRETATION

Taurodontism is characterised by an altered internal dental pulp morphology that results in an elongated pulp chamber of varying degrees[1] with a more rectangular-shaped pulp chamber.[2] As this phenomenon affects the root and pulp morphology and not the crown, radiographs play an importance in the identification thereof. Taurodontism can occur unilaterally or bilaterally and often involves the permanent teeth more than the primary teeth. [3] As the vast majority of associated diseases are related to ectoderm development, one can assume that Taurodontism is a manifestation of the disorder of ectoderm development.[2] Taurodontism can be classified into three broad types using a Taurodont Index which measures the distance from the roof of the pulp chamber to the apex of the tooth.[1] The three types are hypo-, meso- and hyper-taurodont, with hypotaurodont the mildest form and hypertaurodont the most severe form. In mesotaurodontism, the pulp chamber is moderately enlarged resulting in shorter roots, but the roots still remain separated from each other.[3] Image 4 displays tooth 47 with a moderate form of pulpal enlargement and can therefore be classified as a mesotaurodont tooth. In hypertaurodontism, the pulp chamber enlargement reaches the apical area of the root. Images 1 (the posterior molar teeth), 2 and 3 (the posterior molar teeth) are examples of hypertaurodontism. The prevalence of Taurodontism ranges amongst different population groups, with some studies reporting

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a prevelance of 46%.[3] In recent years Taurodontism has been linked to a number of syndromes and conditions such as Down's syndrome, Tricho-dento-oseous syndrome, amelogenesis imperfecta and Klinefelter syndrome to name a few.[2,3] Taurodontism has been considered a marker for other non-syndromic abnormalities such as cleft lip and palate.[1,3] Clinically a taurodont tooth will appear sound, but due to the altered root and pulp morphology there are risks associated. In affected teeth challenges may arise particularly during pulp therapy and root canal treatment due to the increased bleeding in the enlarged pulp and altered root canal configuration. As Taurodontism may be an indication of an underlying, undiagnosed genetic condition, it is important for general dentists to detect affected teeth and be aware of this phenomenon.[3]

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 Pretoria, Faculty of Health Sciences Research Ethics Committee (Reference no.: 543/2022). All procedures followed the ethical standards of the Helsinki Declaration of 1975, as revised in 2008.

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CPD questionnaire

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GENERAL

Prevalence of oral mucosal and periodontal disease amongst patients receiving dialysis

1. Which is the CORRECT answer. What is the most likely cause of mucosal lesions in ESRD patients according to the literature?
   A. Kidney dysfunction
   B. Antihypertensive medication
   C. Diabetes mellitus
   D. Poor oral Hygiene

2. Select the CORRECT percentage. What is the prevalence of periodontitis in South African adults of 35-44 years of age?
   A. 67.4%
   B. 35.8%
   C. 52.3%
   D. 51.6%

Self-reported substance use, in dental and oral hygiene students at a university in South Africa

3. Select the CORRECT statement. Stress amongst dental students:
   A. Is less than amongst their medical peers
   B. Is due to them working long clinical hours
   C. Is due to them wishing they had rather studied medicine
   D. Is greater in first than in final year
   E. All of the above

4. Choose the CORRECT option. Ritalin:
   A. Was originally used to treat insomnia
   B. has an excitatory effect on the brain
   C. Dampens the brains uptake of dopamine
   D. May help those who have chronic fatigue
   E. Has negative effects on memory-associated tasks

5. Which answer is CORRECT. In the present study:
   A. Almost 70 % of students did not use any form of stimulants
   B. Almost half of the respondents used at least 1 stimulant
   C. <5% of the respondents used 2 or more stimulants
   D. A third of those who used stimulants used them on a daily basis
   E. Most of those who used stimulants did so as a once off event

6. Select the CORRECT option. The most common reason for substance use was:
   A. A. To fall asleep
   B. To stay awake
   C. Prescribed for a medical reason
   D. To improve memory
   E. To improve confidence

Dental students' experiences of remote emergency online learning at the University of the Witwatersrand during the COVID-19 pandemic

7. Choose the CORRECT answer. Which learning modality did students indicate they would prefer in the future.
   A. Online
   B. Contact teaching
   C. One with some online course components
   D. One with mostly but not completely online

8. Select the CORRECT answer. What was the major online learning challenge experienced by students during the period of ERL?
   A. Insufficient data
   B. Lack of access to a suitable device
   C. Difficulties managing time
   D. Network and connectivity issues

9. Which of the following is CORRECT. What was the most preferred method of online teaching and learning during ERL?
   A. Videos
   B. Voice-over power point presentations
   C. Online meetings
   D. Tests and quizzes

10. Select the CORRECT answer. What was the students' main reason for enjoying online learning during ERL?
    A. The benefits of working at home
    B. Flexibility of working online
    C. Manageable workload
    D. Attributes of learning methods used

An epidemiological analysis of patients diagnosed with periodontitis at a tertiary institution

11. Choose the CORRECT statement. Regarding risk for periodontal disease, choose the most correct answer below.
    A. Everybody with poor oral hygiene is equally susceptible
    B. Plaque is the primary factor, but several other risk factors play a role.
    C. Systemic risk factors are only important in patients with chronic disease.
    D. None of the above.

12. Regarding the following sentence, choose the most CORRECT statement below: all males have a higher predisposition to periodontal disease.
    A. This is true in all instances because male sex hormones cause periodontal destruction.
    B. This is partially true because several risk factors can influence disease development, such level of oral hygiene and access to healthcare.
    C. This is not true because gender does not play a role in periodontitis.
    D. Periodontal disease progression is influenced exclusively by female sex hormones.

13. Which answer is CORRECT. About diabetes and periodontal disease, choose the most correct option below.
    A. Diabetes increases the risk for periodontitis ap. 3 times, but higher risk can be present in patient with uncontrolled diabetes.
    B. Periodontitis risk is increased in diabetes due to vascular changes and altered immune response to the dental biofilm.
    C. Both A. and B. are correct.
    D. Only A. is correct.

14. About systemic disease that have been studied in relation to periodontitis, choose the most CORRECT option below.
    A. Osteoporosis can increase risk for bone loss, which can manifest in the alveolar bones.
    B. Inflammatory bowel syndrome can increase the risk for oral inflammation and periodontitis.
    C. Infection with HIV virus does not predispose to periodontal diseases.
    D. All of the above are correct.
    E. Only A. and B. are correct.

Cervical Necrotizing Fasciitis: A case report

15. Select the CORRECT statement. Necrotizing fasciitis is.
    A. A hard tissue infection that spreads slowly
    B. A soft tissue infection that spreads slowly
    C. An infection that spreads without regard for facial planes
    D. An infection that spreads along the facial planes

16. Choose the CORRECT answer. The latest guidelines recommend ARV treatment be based on
    A. Dolutegravir
    B. Tenofovir
    C. Lamvivudine
    D. Acriptega

Radiology Corner: Incidental findings of Taurodontism

17. With regard to the radiographic presentation of taurodontism, which of the following statements is CORRECT?
    A. It is characterised by an altered internal dental pulp morphology that results in a shortened pulp chamber.
    B. It is characterised by an altered internal dental pulp morphology that results in an elongated pulp chamber.
    C. It is characterised by an altered crown morphology that results in hypoplastic enamel.
    D. It is characterised by an altered root canal morphology that results in a circular pulp chamber

18. With regard to the type of taurodontism, which of the following statement is CORRECT?
    A. Hypo-taurodontism is a moderate form
    B. Meso-taurodontism is a mild form
    C. Hyper-taurodontism is a severe form
    D. Meso- and hyper-taurodontism are both severe forms

Evidence Based Dentistry

19. Select the CORRECT answer. In the Puljich et al study, which instrument generated the most amount of aerosol and droplet particles:
    A An ultrasonic piezoelectric scaler
    B. An air polisher device
    C. A dental implant osteotomy drill
    D. All of the above

20. Choose the CORRECT answer. In the Li et al study, the survival rates across the 151 implants following radiotherapy after 1 year was
    A. 89.9%
    B. 97.4 %
    C. 99.94 %
    D. 99.99%

CPD questionnaire

Ethics: Trust me – I'm a Doctor

21. Select the CORRECT answer. Objectivity implies that one is:
    - A. showing consistency between actions, values, and outcomes
    - B. trustworthy, loyal, sincere, and fair
    - C. behaving in a manner that allows others to see what actions are performed
    - D. having a well-informed unbiased view on practical matters
    - E. taking responsibility for actions and their outcomes

22. Which of the following options is CORRECT. Doctor: Patient confidentiality may be breached:
    - A. In order to protect the public
    - B. If the patient is a risk to themselves
    - C. If compelled by a court of law
    - D. In all of the above instances
    - E. Only B. and C. above

23. Select the INCORRECT statement. Which of the following is wrong?
    - A. Professional courtesy relates to how clinicians interact with patients
    - B. Dentists who work for themselves can train and employ their own assistants
    - C. Dental assistants may work extended hours if compensated for this
    - D. Dentists should report colleagues if they encounter unethical treatment
    - E. Teamwork may relate to interactions between staff and technicians

24. Select the CORRECT answer. Educational duties may relate to:
    - A. Continual self- improvement
    - B. The duty to educate the public
    - C. Adapting and using new materials
    - D. Only a) and c) above
    - E. All of the above

25. Which statement is INCORRECT? A dentist may refuse to treat a patient if:
    - A. They don't follow good oral hygiene practices
    - B. They don't follow the dentist's advice
    - C. They request purely cosmetic procedures
    - D. They request work outside the dentist's scope of expertise
    - E. They cannot afford treatment but are in pain

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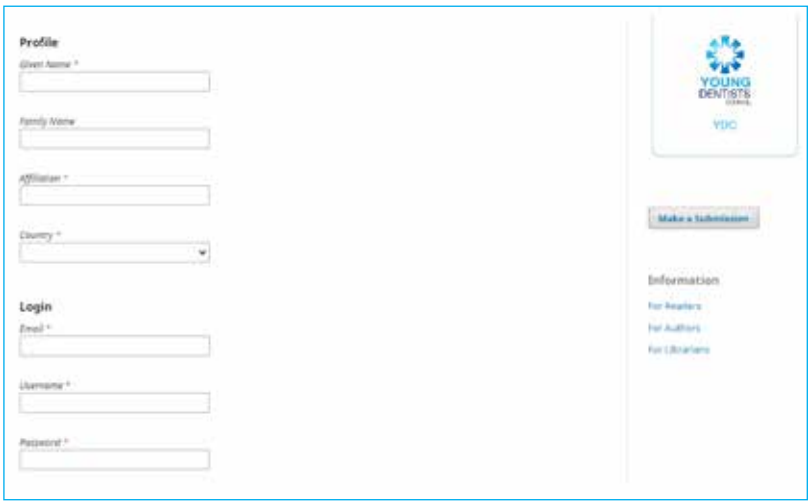

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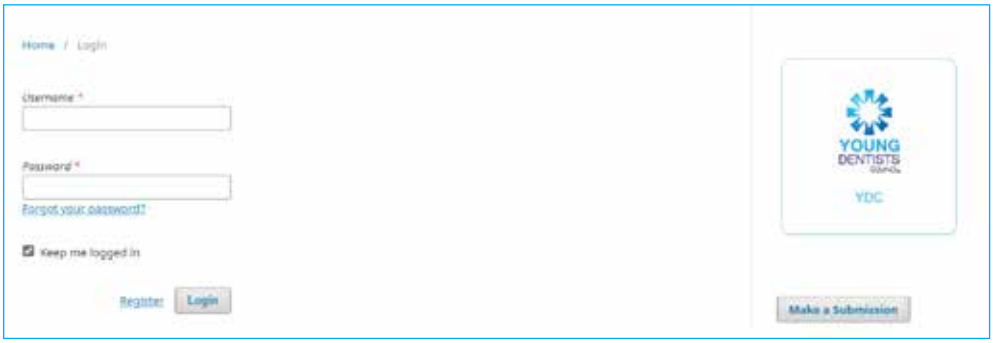

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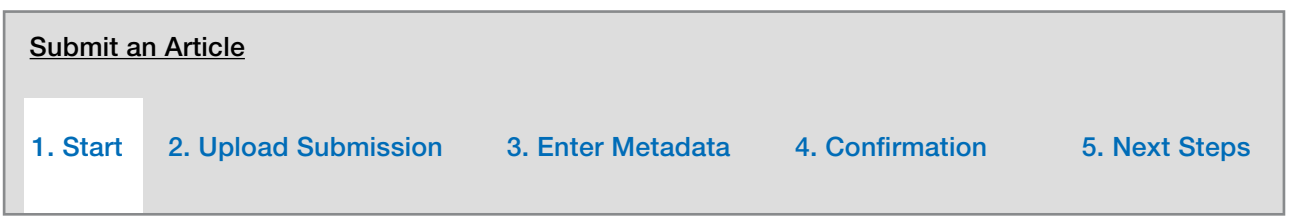

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