THE SOUTH AFRICAN DENTAL JOURNAL

SADJ

AUGUST 2020
Volume 75 Number 7

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

SADA
THE SOUTH AFRICAN
DENTAL ASSOCIATION

Edward Angle - The father of modern Orthodontics

Edward Hartley Angle was a perfectionist who brought to Orthodontics the cult of the highest possible standards, and who is regarded as the father of modern Orthodontics. Born 1855, died 1930, after a life driven by commitment to seek the ultimate in treatment achievement.

THE SOUTH AFRICAN DENTAL JOURNAL
SADJ

Published by:
On behalf of:
SADA
THE SOUTH AFRICAN DENTAL ASSOCIATION

CONTENTS

FRONT COVER PICTURE
Edward Angle …the father of modern Orthodontics 349

EDITORIAL
We are allowed to change our minds - *NH Wood* 350

COMMUNIQUE
During the COVID-19 pandemic, oral health services including routine treatment may continue but must follow established international and South African protocol - *KC Makhubele* 351

RESEARCH
Oral health care for patients undergoing therapy for head and neck cancer in KwaZulu-Natal, South Africa - A qualitative study - *BS Bauluck-Nujoo, S Singh* 353

Development of a tool to measure patient expectations with complete removable dentures - *R Ahmed* 362

The effect of A-dec ICXTM on microbiological water quality in self-contained dental units' water systems - *SP Kgabi, SR Mthethwa* 365

The 'Digital Access Divide' at a South African Dental School – A cross-sectional study - Part 1 - *TC Postma, LM Sykes, A Uys, P Brandt, E Crafford* 373

Dental students' self-perceived competency and usage of the internet for learning and evaluation purposes - Part 2 - *LM Sykes, TC Postma, A Uys, P Brandt, E Crafford* 377

Our Front Cover for this Issue…

The theme for the Front Cover of the South African Dental Journal this year provides for some historical figures, some characters illuminating dental history and some important achievements in South African Dental history.
The cover for August looks at a dentists who is considered the father of modern Orthodontics.

Edward Angle - The father of modern Orthodontics
Edward Hartley Angle was a perfectionist who brought to Orthodontics the cult of the highest possible standards, and who is regarded as 'the father of modern Orthodontics'. Born 1855, died 1930, after a life driven by commitment to seek the ultimate in treatment achievement.

THE SOUTH AFRICAN DENTAL JOURNAL

SADJ

PRODUCTION OFFICE

E-Doc CC,
a Division of Life-Long Learning Solutions CC
Tel: +27 (0)10 020 1013

Publisher and Project manager

Mr René Smulders

GENERAL AND ADVERTISING ENQUIRIES

Mr René Smulders
Email: rene@edoc.co.za

Design and Layout

Ms Reine Combrinck
Email: production@edoc.com

Website smalls advertising / CPD Enquiries and Member contact detail update

South African Dental Association
Tel: +27 (0)11 484 5288
Email: info@sada.co.za

CONTENTS

REVIEW

Dental enamel - *GH Sperber* 384

CASE REPORT

A giant submandibular sialolith - How to manage? - *J Anand, A Suresh, AK Desai* 387

CLINICAL WINDOW

What's new for the clinician? - Excerpts from and summaries of recently published papers - *V Yengopal* 391

RADIOLOGY CASE

Maxillofacial Radiology 183 - *CJ Nortjé* 395

ETHICS

COVID-19 in dentistry - Ethical considerations - *R Maart, R Mulder, S Khan* 396

CPD

CPD questionnaire 400

AUTHOR GUIDELINES

Instructions to authors and author's checklist 403

CLASSIFIEDS

Instructions to authors and author's checklist 407

Published by:

On behalf of:

SADA
THE SOUTH AFRICAN DENTAL ASSOCIATION

Accredited by the Department of Education

SADJ is published 10 times a year by E-Doc CC, a Division of Life-Long Learning Solutions CC, on behalf of The South African Dental Association.

Edward Angle (1855 to 1930)
…the father of modern Orthodontics

A man of considerable complexity, Edward Angle combined a fierce determination to achieve perfection with an uncompromising demand that all those around him should also be imbued with the same commitment.

It was a combination that enabled Angle to become an icon in Dentistry, for he is widely regarded as the father of modern Orthodontics and his concepts and appliances still provide the foundation for much of the discipline today.

He was born in Herrick, Pennsylvania on June 1st 1855. Abandoning the option to continue the family tradition of farming, the young Angle apprenticed himself to a dentist, then enrolled as a student in the Pennsylvania College of Dental Surgery. He developed an abiding interest in the challenges of malocclusion and became known for his innovative views on corrective treatment.

Appointed as teacher in Orthodontics at St Louis and Washington Universities where the subject was a minor component of the Department of Prosthetics, he became convinced that the discipline warranted separate educational facilities.

That became a lifelong objective and indeed resulted in the first institution devoted exclusively to the teaching of Orthodontics… recognised by the State of California in 1924 and designated as The Edward H Angle College of Orthodontia.

Angle devised the classification of malocclusion known eponomously as the Angle system… a contribution with which all students of Dentistry are familiar. He was a tireless inventor of appliances and instruments and wrote many papers describing these advances.

Never bashful about his ideas, he energetically advocated their application… one of his papers was entitled "The latest and the best in Orthodontic Appliances".

He developed the Pin and Tube appliance, the expansion E arch, the Ribbon arch and, in 1925, his crowning contribution, the Edgewise appliance. This last technique has been the basis for the evolution of the sophisticated brackets in use today. The biological principles which he recognised and on which he relied are those currently guiding the profession.

Edward H Angle was trained as a dentist, but made orthodontics his speciality and dedicated his life to standardizing the teaching and practice of Orthodontics.

Often dismissive of any who failed to meet his standards of commitment, ethics and ability, he expected his students to strive continuously towards the self-discipline he considered essential to approach perfection.

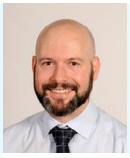
Students of today will be intrigued to learn that Angle instructed his students to clean the surgeries and workplaces, scrubbing the floors and sweeping the offices!

The influence of this extraordinary man has been worldwide. Orthodontists the world over have figuratively sat at the feet of this pioneer, absorbing the philosophy, the commitment and the principles which he embodied. The message goes much further than the practice of the profession… he expected the highest ideals in every aspect of life.

We are allowed to change our minds

SADJ August 2020, Vol. 75 No. 7 p350

NH Wood
Managing Editor of the SADJ



During this lockdown period, we saw the development and implementation of various policies and procedures that have probably changed the face of the dental practice for the future. Many facets of the dental practice have been influenced by this pandemic. These range from the obvious infection control, to patient communication and billing, and even staff interactions in our clinics.

How do we know what we did was right, or enough? Have we asked the right questions to provide our patients with the best available care under the most constraining circumstances?

Evidence-based outcomes derived from scientific observation form the foundation for the development of most opinions, policies and procedures. It is in this dynamic process that we find recommendations and innovation being put forward, withdrawn, re-worked, and published again.

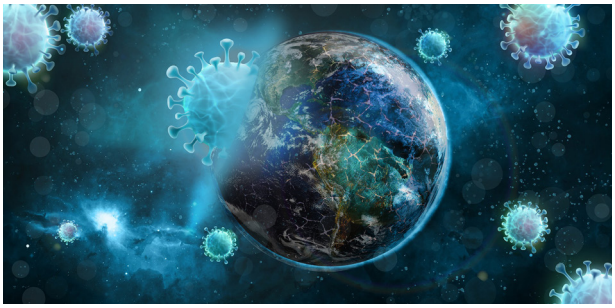
We rely on our observations between cause-and-effect to narrow our focus to be able to advise more accurately and to inform on policies like infection control procedures. We then label this as "current best practice" and continue to improve thereon through continued observation. We will therefore change our minds on different approaches or procedures, and this is a manifestation of good science.

Traditionally, research is conducted in a controlled environment, where the researcher has already designed the project and made every effort to control for confounding factors, variables, and any bias. There are times, such as for this pandemic, when policies must be formed hurriedly and be put into practice at large.

In these circumstances we integrate our observations of similar situations from the past, published resources, and empirical knowledge of peers, to generate a form of surrogate policy that is applicable to the current situation.

As the system develops, changes may be required based on real-time observations. We have seen this play out on the COVID-19 stage. We can also agree that there is no policy that can be uniformly applied "as is" to every dental setting in our country, and some leave room for interpretation.

Therefore, the final decision-making lies with the operator who takes responsibility for analysing risk, and for the safety and well-being of all who enter the premises,



and also on every clinician individually, who will engage a patient. The decision is taken on available knowledge and evidence to the practitioner in that moment in time.

Some may argue that we were too paranoid during lockdown. I put it to those that everything that was done to prevent any further spread of SARS-CoV-2 infection was well worth the effort. We have gathered an immense amount of data and experience, and therefore learnt a great deal about our own systems management and policy implementation in practice. Over and above, we have saved many lives.

Five months after the first announcement by President Cyril Ramaphosa that South Africa will enter into a national lockdown due to the COVID-19 pandemic, we find ourselves at level 2. For most of us this was an intensely trying time, and many of us have breathed a sigh of relief when the level 2 lockdown announcement came. Although national government has relaxed our lockdown level, I'd like to remind you that this action was due to our healthcare system being able to cope with cases of COVID-19. Therefore, do not relax your own personal protection and that of those around you. More than ever, we need to remain vigilant and be aware of our personal space.

On a happier note, the South African Dental journal will shortly be hosted online embracing the fourth industrial revolution, and become more oriented in technological advances. Our online platform will feature a manuscript-tracking ability from author submission to the final publication. We hope these advances prove beneficial for authors and reviewers alike in our effort to make our journal systems more efficient. The editorial team looks forward to working with you on this new platform which will soon be officially launched, and we hope that our authors and contributors take full advantage of this platform.

We are pleased to present you with the August edition of the South African Dental Journal and thank our reviewers and contributors for their hard work to make this continued output a success.

Neil H Wood: Managing editor. Email: neil.wood@smu.ac.za

During the COVID-19 pandemic, oral health services including routine treatment may continue but must follow established international and South African protocol

SADJ August 2020, Vol. 75 No. 7 p351 - p352

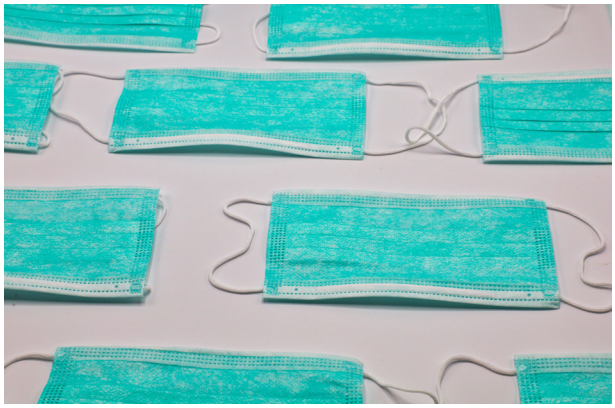
KC Makhubele
CEO of SADA

The South African Dental Association (SADA) hereby responds to the statement released by the World Health Organization (WHO): Considerations for the provision of essential oral health services in the context of COVID-19, on 7th August 2020

After careful consideration and in consultation with workstreams working in various protocols regarding the provision of oral health services during the COVID-19 pandemic, SADA respectfully yet strongly disagrees with the World Health Organization's (WHO) recommendation to delay "routine" dental care in certain situations due to COVID-19.

A blanket statement such as the recent one by the WHO cannot, therefore, be supported. It is without a doubt that oral health is integral to overall health and neglect and delay of certain treatments may lead to extensive damage and increased financial implications to correct.

Consequently, dentistry is essential healthcare, because of its role in evaluating, diagnosing, preventing or treating oral diseases, which can adversely affect systemic health. Each country is at a different stage of the pandemic and each country has to respond appropriately based on its assessment of its unique situation.



The South African Government has set out clear guidelines at various stages of alert. This is the context in which the profession operates.

Our stance is supported by the decision of the FDI World Dental Federation, which SADA belongs to. The FDI is made by approximately 200 country (National) dental associations in about 130 countries internationally. Following the general provisions of the WHO regarding oral health services, SADA published a well researched and widely supported protocols - The SADA Dental Clinical Protocol, available at **www.sada.co.za**, to ensure that patients, staff and healthcare workers are adequately protected.

The SADA Dental Clinical Protocol to which all dentists should adhere rests on the following four pillars:

1. Proper ventilation of the practice.
2. The use of high-volume evacuation (HVE) to evacuate aerosols.
3. The use of rubber dams (a protective film to isolate the oral cavity) whenever possible in combination with HVE.
4. The correct use of appropriate PPE during each procedure.

SADA, therefore, support the FDI statement that "… oral healthcare is essential to maintaining good overall health and routine care is necessary for the early detection, prevention, and control of oral diseases.

FDI advocates that every opportunity should be utilized to reinforce oral health promotion and prevention messages to help reduce the need for avoidable dental visits. But, at the same time, governments must ensure continued and equitable access to essential oral healthcare services, as well as the availability of appropriate personal protective equipment (PPE), to avoid an even bigger burden on health systems in the future."

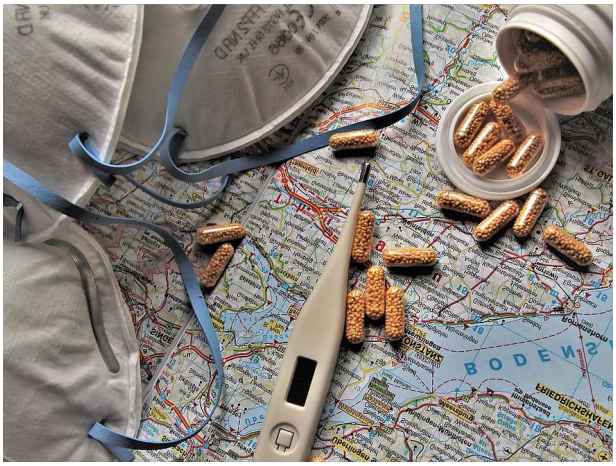
In line with the general healthcare preparations made to cope with the first wave of expected COVID-19 cases, SADA, with unprecedented support from its dentistry community, formalised a clinical workstream to establish a protocol for how oral healthcare workers (OHCWs) could work during the pandemic.

We realised that we would need to be active during times of high viral load, as the threat of infection was very low during our actual lockdown.

The dental environment is naturally high-risk due to the unavoidable contact between patients and OHCWs, which increases the possibility of transmitting HIV, resistant TB, etc.

Stringent standard of care in the sterilisation and disinfection protocols is thus standard practice. However, the possibility of an airborne vector needed to be incorporated into our standard operating protocol. We acknowledge that there is still much to be learned about the coronavirus, therefore we adopted the route of the worst-case scenario.

We accepted the possibility of airborne spread very early (March 2020) and considered the scope of the virus in preparing a document containing clinical standards and procedures under which the OHCW's could function safely and the health of OHC staff, patients, and the population at large would be safeguarded.

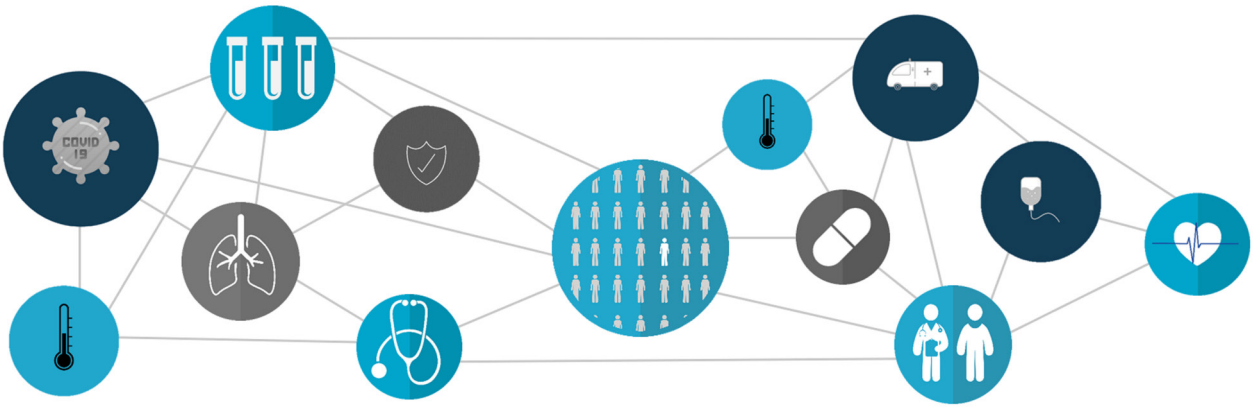


This document included opinions from South African dentists, the academic dental deans of all South African universities, specialists, experts in the field and the dental legal fraternity.

SADA recognizes the need for our patients not to be denied any treatment that could be detrimental to their oral or general health. In light of this principle during lockdown Level 3 and below, most dental procedures are permissible, with strict adherence given to proper protocol.

Routine dental visits are therefore encouraged where a dental practice strictly adheres to the SADA and other relevant protocols. The public at large should not unnecessarily delay treatment if a need arises.

Where members of the public are concerned, they are welcome to source information from our website and or contact the SADA offices.



http://dx.doi.org/10.17159/2519-0105/2020/v75no7a1

Oral health care for patients undergoing therapy for head and neck cancer in KwaZulu-Natal, South Africa - A qualitative study

SADJ August 2020, Vol. 75 No. 7 p353 - p361

BS Bauluck-Nujoo[1], S Singh[2]

ABSTRACT

Background

There is limited published evidence in KwaZulu-Natal on access to oral health care for patients undergoing cancer therapy in the head and neck region.

Objectives

This study aimed to assess patients' oral health-related perceptions, practices and needs during cancer therapy.

Methods

This was a descriptive case study. A semi-structured face-to-face interview was conducted with volunteers (n=12) undergoing cancer therapy in head and neck region. Purposive sampling was used to select study participants who were recruited from a public tertiary central referral hospital in KwaZulu-Natal. A semi-structured interview was also conducted with the eThekwini district coordinator for oral health services to gain better insight into oral health service delivery for patients with special needs.

Results

The results indicated that oral health care in the sample population was not prioritised. Some of the emergent themes included: participants' knowledge and oral health self-care practices, support for participants to cope with head and neck cancer, barriers in accessing facility-based oral health care (poor access to dental services, failure of the local clinic to provide appropriate care), lack of referral by oncology care practitioners for patients to access dental care, and existing gaps in oral health service delivery.

The reported non-existence of a specific oral health policy to address cancer and the absence of a risk factor intervention program highlighted some of the shortcomings for quality oral health service delivery in this population group.

Conclusion

The results indicated that oral health care is important for patients undergoing cancer therapy. There is an urgent need for oral health planning in the province to take into account the specific oral health needs of this vulnerable population.

Author affiliations:

1. **Bibi S Bauluck-Nujoo:** *BDS (SSR Medical College-University of Mauritius), M.MEDSc (UKZN),* School of Health Sciences, University of KwaZulu-Natal, South Africa.
   ORCID Number: 0000-0002-7157-5122
2. **Shenuka. Singh:** *B.OH, M.Sc (Dent), PhD (UWC), PG Dip Heal Res Ethics (Stell),* Associate Professor: Discipline of Dentistry, School of Health Sciences, University of KwaZulu-Natal, South Africa.

Corresponding author: Shenuka. Singh
Discipline of Dentistry, School of Health Sciences, University of KwaZulu-Natal. Private Bag X54001, Durban, 4000.
Email: singhshen@ukzn.ac.za

Author contributions:

1. **Bibi S Bauluck-Nujoo:** First author - 70%
2. **Shenuka. Singh:** Second author - 30%

INTRODUCTION

The increasing rate of cancer in the developing world, including the incidence of cancers located in the head and neck region, remains a huge public health concern.

Oral cancer ranks as the sixth most common cancer on a global level and third in developing nations, with a high age standardized mortality rate (ASMR) of 6.8 (per 100,000 persons per year).[1,2] Similarly oesophageal cancer is ranked as the eighth leading cancer by the global cancer statistics database (GLOBOCAN) and accounted for 3.2% of new cases in 2018.[3]

It is further postulated that probably 'two-thirds of oral and pharyngeal cancers (excluding nasopharynx)' occur in developing countries.[2] Alarmingly these countries 'account for 67% of cancer-related deaths' yet only '5% of cancer-related spending' is evident in response to this public health crisis.[4]

The high cancer mortality rates in developing countries could be attributed to patients' late presentation for diagnosis and treatment, suboptimal access to health care services, or patients opting to seek traditional health care before attending a health care facility.[1]

Some of the possible reasons for delays in accessing the health system could include cultural beliefs that cancer "is a curse", poor socio-economic status, and challenges with availability of transport.[5] These challenges complicate treatment outcomes and disease prognosis, which could in turn, place further strain on an overburdened health system.

Given the disproportionate dependence on public oral health care in developing countries, it is inevitable that similar challenges would occur with patients presenting with head and neck cancer (HNC).

HNC collectively could include anatomical sub-sites such as the pharynx (including hypopharynx, nasopharynx and oropharynx), larynx, paranasal sinuses and nasal cavity, minor and major salivary glands, oral cavity (including lip, alveolar ridge, buccal mucosa, gingiva, tongue, retromolar trigone and floor of mouth), ear, skin, eye and in some instances, the brain.[6-12]

However, there is no general consensus on this definition of HNC, given that the epidemiology, histopathology and aetiology of tumours vary in the head neck region.[13] Conversely cancer incidence rates involving the lip, oral cavity and tongue, pharynx and larynx could be aggregated.[14] The current reporting systems for HNC add to this complexity in that, databases could report cancer rates based only on the specific anatomical location.

More confusing, 'terminologies such as oral cancer", "orofacial cancer", "oropharyngeal cancer", "head and neck cancer" have been used interchangeably' and this inconsistency in the 'nomenclature' complicates reporting on the epidemiology and burden of HNC.[1:478] One plausible way to overcome this impasse in defining and describing HNC would be through the use of rubrics developed by the International Classification of Disease (ICD-10) for oncology.[15]

Likewise the prevalence of HNC in South Africa and in other parts of Africa remains unclear due to a number of other complexities. These include under-reporting of cases in areas where there are poorly developed or non-existent cancer registries and inadequate health infrastructure.[1] The current trends in HNC are alarming.

Adeola et al. used a cohort of 12 selected countries to illustrate HNC, oesophagus and Upper Aerodigestive Tract Cancer (UADTC) ranking. The authors concluded that South Africa was ranked fourth in the list for HNC and second for UADTC.[1] Similarly a human papillomavirus (HPV) prevalence rate of 6.3% was recorded in a cohort of South African patients presenting with head and neck squamous cell carcinoma.[16]

According to data derived from the South African National Cancer Registry (SA-NCR) between 1996 and 2002, the average oral cancer ASIR (age standardized incidence rate) for males was 6.19/100,000/ per year and 1.60/100,000/per year for females in the country. About 6.2% of all non-skin cancers were registered as intra-oral and lip cancer in South Africa thus suggesting that these are arguably the most common HNC in South Africa.[17,18]

Another study using SA-NCR data (1988 until 2012) for oral, lip, oropharynx and nasopharynx cancer in South Africa showed a 30% decrease in intra-oral cancer rates for males (except Coloured men) and only a slight decline for lip cancer in males and intraoral cancer for females (except Black women).

The authors however added that registry data must be reviewed with caution given its variability and in some instances, unreliability.[17] What remains clear is that HNC can be attributed to unhealthy lifestyle practices (poor dietary intake) and risky behaviours such as smoking, alcohol consumption, and sexual practices (that could contribute to HIV/HPV infections).[1]

The head and neck region is critical for basic functions such as chewing, swallowing, speech, breathing and hearing, thus cancers affecting this region will have an impact on individual quality of life. The common oral complications associated with HNC include oral mucositis, decreased salivary flow, taste disorders and pain.[19-21] Patients have reported difficulty in eating, dysphagia (difficulty to swallow), odynophagia (painful swallowing), gustatory and auditory disturbances (due to oral mucositis and xerostomia), osteoradionecrosis, periodontal disease, trismus, hypersensitivity and recurring infections.[19,22-26]

Additionally around 58-97% of patients diagnosed with cancer could require some form of dental treatment before cancer therapy.[27] This necessitates the availability of appropriate oral health care to support patients through the journey of cancer diagnosis, treatment, post treatment and rehabilitation. Oral health-related management of the patient should commence prior to cancer therapy and then intensified during the treatment phase, thereafter ensuring post cancer treatment support.[28,29]

Despite the value and role that oral health services can play in contributing to improved oral health outcomes for patients with HNC, there is paucity of published evidence in this field. Similarly, there is limited publicly available evidence that oral health planning in KwaZulu-Natal takes into account the specific oral health needs of patients with HNC.

To our knowledge, there is no published data that specifically explored HNC patients' perceived oral health needs and demand for oral health care in the province. This study thus aimed to assess perceptions of patients undergoing cancer therapy, their oral health practices, and the public oral health system's response to addressing care for patients with HNC.

METHODS

This was a descriptive case study using qualitative data to explore HNC patients' perspectives on oral health care. Studies using a qualitative approach are mainly concerned with observing patterns and trends in a data-set ('understanding the meaning') rather than quantifying the phenomenon being studied.[30]

Gatekeeper permission was obtained from KwaZulu-Natal Department of Health and ethical clearance was obtained from the University of KwaZulu-Natal (BREC Ref Number: BE 041/17). The study site was a public tertiary central referral hospital located in the eThekwini Metropolitan Municipality within the province of KwaZulu-Natal.

The study population comprised 12 voluntary participants

(n=12) undergoing active cancer therapy or attending follow-up sessions for maintenance therapy (patients in remission). Data saturation technique was used to determine the final study sample size.[31]

Volunteers were purposively selected from the waiting area in the Oncology unit. The study purpose was explained to all patients, and participants were only recruited after written informed consent was obtained from each interested person. A semi-structured face-to-face interview was set up, based on the willingness and availability of each participant.

Ethical considerations such as participant privacy, confidentiality and the right to withdraw from the study were discussed before the interview. The interview schedule comprised demographic questions related to the date of diagnosis, duration of treatment, present treatment regime, and lifestyle induced habits. Other open-ended questions included the participant's knowledge of oral health care in relation to overall well-being, oral health self-care practices, perceived barriers and opportunities to access oral health care, and availability of support to cope with the illness. An unoccupied room in the oncology department was used to conduct the interviews after prior arrangements were made with the oncology staff. This enhanced participants' privacy during the interview. The duration of the interview was 30 minutes.

Purposive sampling technique was used to set up another semi structured face-to-face interview with the oral health district coordinator in eThekwini Municipality. The interview schedule comprised questions related to oral health strategies in place to support patients with HNC and the extent to which oral health care covered in district health policy and planning. Other questions included existing institutional support for oral health promotion activities such as risk factor intervention programmes. The interview appointment and venue were based on the district coordinator's availability and convenience. The duration of the interview was 30 minutes. All interviews were audio-recorded.

For the data analysis process, the audio-recordings were first transcribed verbatim by a transcriber and a data clean-up process was applied. The narrative from each interview transcript was then coded and analyzed based on the conventional thematic analysis approach, described by Braun and Clarke.[32]

A code guide was developed to guide and support the coding process. Open nodes were generated in the open coding phase. This form of coding allows for inductive reasoning of the emergent themes. Inductive thematic saturation was used in data analysis process. This means that data analysis was concluded when no new codes or emergent themes could be derived from the collected data.[33]

Credibility was maintained by ensuring that the researcher had prior engagement with the research participants to build trust. Confirmability was maintained by doing an "audit trail" which took into consideration the pathway from data collection to data analysis. Transferability was ensured by providing a thick description of the data collection process, characteristics of participants and the data analysis process. Dependability was achieved through a clear description of the study methods and processes.

RESULTS AND DISCUSSION

Several themes were identified in this study: participants' knowledge and oral health self-care practices, support for participants to cope with HNC, barriers in accessing facility-based oral health care, lack of referral by oncology care practitioners for patients to access dental care, and existing gaps in oral health service delivery.

Table 1. Profile of study participants.

Participants	Date of Diagnosis	Duration of Treatment	Present Treatment Regime			Past Habits and Duration		
			Radiotherapy	Chemotherapy	Surgery	Smoking & Duration (Years)	Alcohol & Duration (Years)	Paan Chewing & Duration (Years)
P1	Oct-16	3 months		√		√ 18	√ 10	X
P2	Oct-16	1 month	√	√		X	X	X
P3	2013	30 days	√			X	X	X
P4	Jan-17	August		√		√ -	√ Occasional	X
P5	Jan-16	31 days		√		X	X	X
P6	Apr-17	26 days	√			√ 10	√ Occasional	X
P7	Jun-15	Not yet started				X	X	X
P8	Nov-16	Does not know		√		√ 5	√ 6-7	X
P9	2014	Forever	√	√		√ 20	√ 20	√ 10
P10	2015	Does not know	√			X	X	X
P11	Nov-16	Not been told			√	X	X	X
P12	Apr-16	Does not know	√	√		√ 15	√ 10	X

X: No √: Yes

The demographic profile of participants outlined in Table 1. The results indicated that almost half of the study participants had engaged previously in risky behavioural practices such as smoking and alcohol consumption.

Theme 1: Participants' knowledge and oral health self-care practices

Most participants indicated that oral health care was important for their overall well-being (Table 2). Participants also highlighted the important roles that key health care workers (including oral health workers) can play in creating awareness and support for optimal oral health care, as part of the clinical management for HNC.

Treatment for HNC could involve surgery, radiotherapy, chemotherapy and concurrent chemoradiotherapy.[34–36] These multimodalities in the treatment of HNC could potentially impact on oral health status[37] and influence individual quality of life.[38,39] Dental health care workers are therefore critical in providing patient support and counselling in aspects related to healthy lifestyle practices and optimal oral health self-care.[40]

Theme 2: Support for patients to cope with HNC

This theme highlighted available support for study participants at a personal level. Most participants indicated receiving moral or financial support from family members. Moral support could contribute to better handling of psychological and physical challenges that patients face during diagnosis and clinical management of the health condition.[41]

Financial support is also important given the financial strain caused by loss of employment or time spent away from work.[42] One interviewee highlighted the role of prayer as a form of spiritual support. This finding is supported by other studies that also conceded the value of prayer to help reduce anxiety and stress in patients with HNC and improve overall well-being.[43,44]

Theme 3: Barriers to accessing oral health care

Although participants recognized the importance of oral health care, the costs for purchasing oral health care products remained a challenge. Likewise some participants living in underdeveloped areas in Empangeni and Oakford outlined challenges in accessing facility-based oral health care. This was possibly due to the reported limited availability of easily accessible public dental clinics or private dental surgeries in these areas (Table 3). This finding is consistent with other studies that highlight challenges in accessing oral health services can result in a greater burden of unmet oral health needs in socially and economically marginalised populations.[45]

Imbalances in oral health service delivery is a reality on multiple levels in South Africa. Imbalances occur in the skewed public-private distribution of oral health care workers and the urban-rural divide in the availability of public dental clinics. Public oral health services are in turn largely characterized by inequities in funding for oral health care, poor infrastructure and staff shortages

Table 2. Participants' perceived knowledge on oral health and oral health practices.

Perceived knowledge of oral health and oral health practices	Responses
1. Do you think that oral health is important in relation to your well-being? How?	
Perceived knowledge of oral health:	"Yes. The dentist said the health of the mouth is important and to keep my teeth clean" (**P1**). "I think it is important that my mouth must be clean so there are no germs. The doctor explained the benefits and complications and told me about the side effects that there is going to be dry mouth, dark skin, hair loss" (**P3**).
2. How do you keep your mouth clean?	
Oral health practices:	"I go to a private dentist. I brush in the morning and sometimes at night but I always gargle at night" (**P1**). "Brushing, flossing and mouthwash" to maintain oral hygiene (**P2**). "The doctor told us that as soon as radiation will start some of these areas (he was referring to the lips) are going to be disturbed so I must boost myself" (**P7**).

Table 3. Support for oral health care.

Familial Support	Responses
A. Familial Support:	
How has your family supported you to obtain treatment?	
1a. Lack of support	"Basically, I have been doing everything myself from the day I came out. I have been confident; I have been coming for treatment myself. I have no back up" (**P9**).
1b. Moral support	"They were supportive and tried to help. They are always there for me" (**P7**).
2. Financial Support	"They supported me a lot financially and caring for me" (**P11**). "They give me money to see a doctor" (**P12**).
3. Telephonic conversation	"They support me by calling me asking me how I am doing" (**P3**).
4. Support through visit	"They come to visit" (**P6**).
5. Prayer and advice	"My family was also confused and they supported me through prayer and advice" (**P8**). "That is why sometimes I get stressed. I am not smoking. I am not drinking why I get the cancer. I am going to church so why does the bad things go through to my life" (**P10**). "They were supportive and tried to help. They are always there for me" (**P7**).

(including lack of appropriate skills-mix to meet the needs of local communities).[46] An adequate workforce is critical for delivery of quality oral health care given that almost 80% of the South African population are dependent on public oral health services.[47]

These resource linked shortages inevitably impacts on the availability and consequently, the quality of facility-based oral health care.[45] Poor investments in public oral health services can be traced back to poor policy decisions, especially when oral health priorities remains low on the health policy agenda.

These collective challenges will ultimately impact on disadvantaged communities' access to oral health services (Figure 1) and their subsequent utilization of these services. There is thus an urgent need to review health policy priorities such that the quality and access to oral health care can be improved. One possible way would be to explore public-private partnerships in oral health care, so as to increase access in facility-based oral health care for vulnerable populations.

The perceived lack of referral by oncology doctors for patients to access oral health care was seen as an additional barrier. This shortcoming is supported Lawrence et al. who pointed out that medical practitioners might not recognize the value of dental assessment and oral health care in this population group.[20] Another perceived barrier was inadequate dissemination of information related to oral complications of chemotherapy by oncologists and nurses.

This finding is consistent with Abed et al. who reported that patients felt that they received inadequate preparatory information on oral health related side-effects of treatment related to HNC.[48] Pai and Ongole also reported that nurses working with cancer patients had inadequate oral health-related knowledge for patient management.[49]

There is need for continuous inter-professional evidence-based oral health care education 49 to ensure that oral health related information is consistent and readily available to patients with HNC.

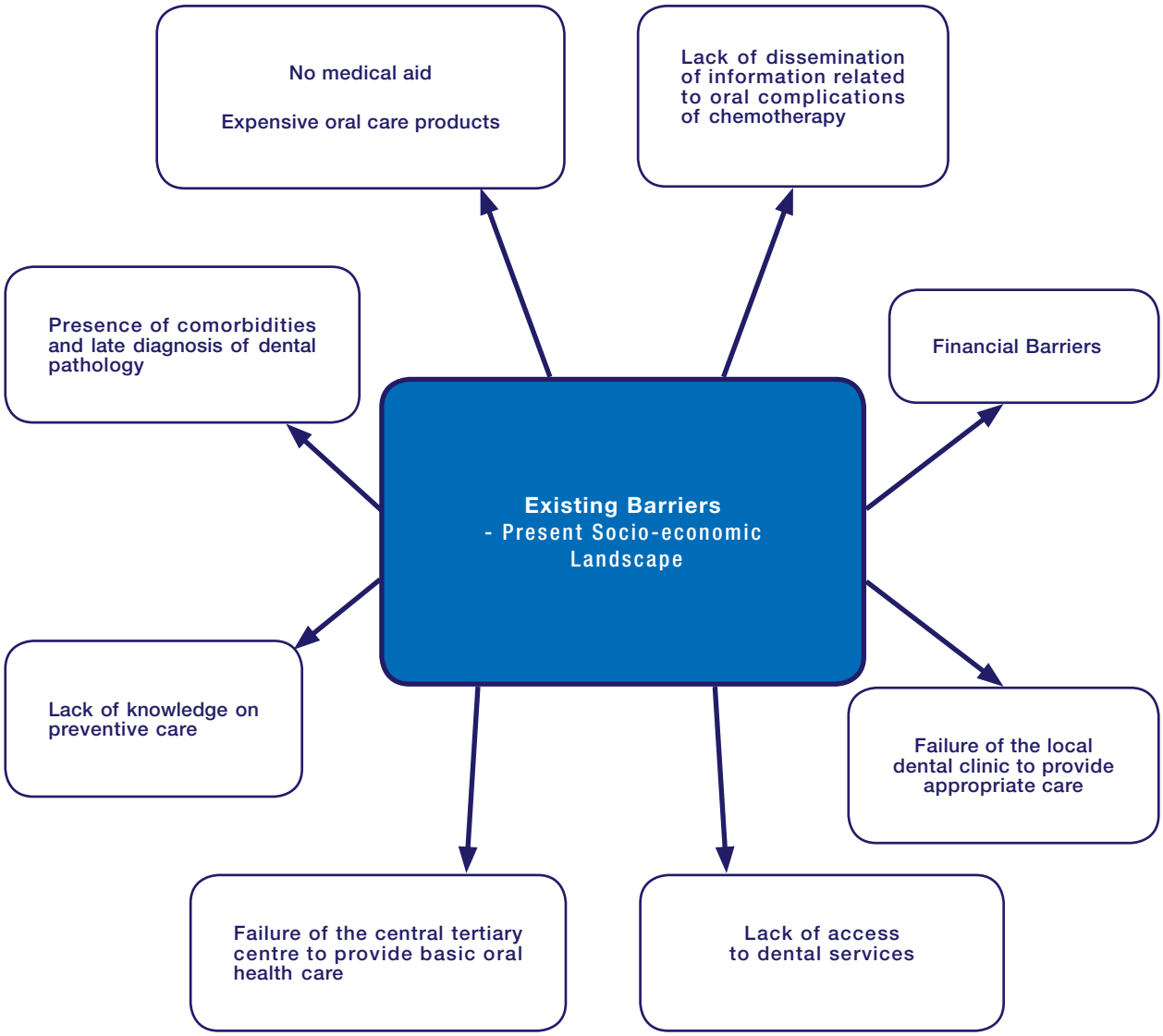


Figure 1. Barriers perceived by participants to access oral health care.

Participants in this study also highlighted challenges in accessing oral health care due to existing co-morbidities. The co-existence of diseases such as hypertension, diabetes, obesity and bone loss could complicate care and health outcomes for patients with HNC. Oral health care becomes a low priority in the presence of other health conditions requiring urgent attention. This finding is supported by a study conducted in North Carolina where patients with oral complications experienced poor emotional and physical health outcomes compared to those with no oral health-related issues.[50]

Theme 4: Gaps in oral health service delivery

The interview with the district health coordinator suggested that oral health strategies remain isolated from general health interventions, as indicated in the following quotation:

We do not have a separate policy on oral health care for head and neck cancer patients. I have not seen one specifically for head and neck patients. But we got a specific policy in KZN to decrease the filling to extraction ratio (Oral health district coordinator).

From an oral health service delivery perspective, the district coordinator indicated that support was available for patients. This included identification of suspicious lesions during routine clinical examinations, oral health counselling and motivation to reduce risky behavioural practices such as smoking and alcohol consumption, and referral pathways for further clinical management.

However, a gap was identified in the availability of lifestyle induced risk-related intervention programmes:

We do not have any (risk factor intervention program) but we do encourage all our patients not to smoke and drink (Oral health district coordinator).

A risk factor intervention program is important to address common risk factors for non-communicable diseases (in this case head and neck cancer) as part of health determinants.[51] The Common Risk Factor Approach creates an opportunity for oral health promotion to be incorporated into general health care. This approach is supported by the South African Oral Health Promotion framework.[51]

Education addressing the impact of tobacco smoking, alcohol consumption, areca nut-chewing and other risk factors should form part of an appropriately structured oral health promotion programme.[52] A community level educational campaign and dedicated homebased care could be more beneficial, if properly implemented.[52]

Additional staff and resources could improve the quality of oral health care offered by the health system. This reiterates the need for a multidisciplinary team approach that includes oral health care workers for the comprehensive management of HNC.

Thus, oral health care should be the combined responsibility of all role-players in the multidisciplinary team for managing patients with cancer.

Table 4. Existing barriers to oral health care

Barriers at individual level	Responses
Do you experience any difficulty to buy stuff to keep the mouth clean? Is it difficult for you to go to the dentist?	
No medical aid and expensive oral products	"I did not have medical aid so they referred me. Yes I experience difficulty to buy stuff to keep the mouth clean because they are expensive" (**P1**).
Lack of dissemination of information related to oral complications of chemotherapy	"They didn't say anything at all about importance (of oral health); they didn't mention it could have an effect on the teeth" (**P2**).
Financial barrier	"We do not receive things like toothpaste and toothbrushes, it is expensive because my dad collects a disability grant. It is a financial strain because he wears diapers and all that has to be bought with his pension money" (**P4**). "Yes since I started this treatment I have difficulty because the money is getting short. We are using R96,00 a day for transport. It is difficult. We cannot afford to go to the private dentist and doctors where you have to pay more than the government hospitals. Money, it is very expensive for us because we are no longer working" (**P6**).
Failure of the local dental clinic to provide appropriate care	"They see so many patients a day. After 12.00, they do not take any more patients. If [you go to the clinic] after 12.00. you must come back the next day. They do not do most of things, they just do general extractions. So we have to go to private dental practitioners" (**P4**).
Lack of access to dental services	"There are no dentists around where I live. It is like one hour's drive" (**P5**).
Failure of the central tertiary centre to provide basic oral health care	"They see so many patients a day. After 12.00, they do not take any more patients. If [you go to the clinic] after 12.00. you must come back the next day. They do not do most of things, they just do general extractions. So we have to go to private dental practitioners" (**P4**).
Presence of comorbidities and late diagnosis of dental pathology	"I have chronic pancreatitis and I am diabetic. I do not know whyl am still losing weight. I am 50 kgs. I was 80 kgs. It took the hospital about one and a half years to find out that I have cancer. The operation was done within a month because it was that serious" (**P9**). "Yes now, before it wasn't difficult to go to the dentist although it was not too near, but now not anymore because of weakness" (**P6**).

Table 5. Institutional support for oral health care (Response from the oral health district coordinator).

Institutional Support from a policy perspective and Referral Mechanism	
1.Is there any institutional support for oral health promotion activities for patients with cancers of the head and neck region? What is your opinion?	
1A. Institutional Support	"We do not target a specific group of patients. We target all patients. For head and neck cancer patients, we have to make sure that their oral health is maintained to optimum level by cleaning and polishing twice or thrice a year. We do have oral hygienist to do the cleaning and polishing for all the patients who require cleaning. If cancer patients require dentures we got facilities for that".
1B. Referral Mechanism	"While examining the patients we tell them what needs to be done and if we feel that the patient has got something which looks like squamous cell carcinoma, we refer them to ENT or Oncology for further investigation. We do small biopsy but anything major we refer to ENT or Maxillo-facial".
2. Access to care	
2A. What are some of the challenges you think these patients encounter?	
Good infrastructure	"I don't think there are because it is open for all. eThekwini for example has got 17 hospitals and clinics. We got 7 major hospitals and lots of CHC's".
2B. What can be done to improve access to oral health promotion activities for these patients?	
Poor resource allocation	"Human resources and financial resources are the two most important things. If we can have more staff and financial resources we will definitely improve access to oral health promotion for these patients".

This finding is supported by MoI on the role of the health system, including oral health workers, to support patients diagnosed with cancer.[53]

Oral hygienists can also add value to a multidisciplinary team through the provision of preventive treatment plans tailored to individual patient needs.[54]

It is equally important that health interventions such as screening and early detection of cancer are incorporated into oral health service delivery. Early recognition of pre-malignant lesions through screening programs and population-based health education have shown to have favourable prognostic health outcomes.[55]

Thus there is need for appropriate training and skills transfer for oral health care workers (depending on the scope of practice) to screen, diagnose, refer or provide early interventions for premalignant and malignant lesions in the head and neck region.[56]

This requires continuing professional development in this area.[57] It should be noted that support for oral health self-care practices should extend beyond the health system. Oral health care should be integrated into other key community-based activities such as support group programmes for people with cancer.

Strategies such as oral health education, tooth brushing and flossing techniques, as well as the availability of non-alcohol based mouth rinses should be integrated into general support programmes for people with cancer.[40]

Collectively these efforts can make significant contributions to improved quality of life for people with HNC. More research is needed to explore further opportunities to improve quality of life in people with HNC.

Limitations of the study

The study findings cannot be generalised. The study participants were drawn from a single site and the results cannot be extrapolated to other provinces and districts. Participants in this study were at different stages of treatment regimens.

A patient undergoing treatment could have a very different experience/knowledge of oral health care related to HNC compared to those starting with treatment. More research is required on newly diagnosed patients to assess their knowledge of oral health need at "day zero", that is, at the commencement of clinical management for HNC.

Nevertheless, this study provides valuable data on patient perspectives to oral health care. Future research in this area can be extended to other provinces in South Africa so as to obtain a national picture that could inform and influence oral health planning to meet the needs people affected by HNC.

CONCLUSION

The results indicate that support for oral health care is important for patients with HNC. There is an urgent need for oral health planning in the province to take into account the specific oral health needs of this vulnerable population.

Acknowledgements

Study participants for their generous contribution to this study.

Declaration

The authors declare no conflict of interest.

Funding

This paper forms part of a Masters dissertation for the first author. A scholarship of R25,000.00 was obtained from the College of Health Sciences, UKZN.

References

1. Adeola H, Afrogheh A, Hille J. The burden of head and neck cancer in Africa: the status quo and research prospects. South African Dent J. 2018; 73(8): 3-5, https://doi.org/10.17159/2519-0105/2018/v73no8a1.
2. Warnakulasuriya S. Global epidemiology of oral and oropharyngeal cancer. Oral Oncol. 2009; 45(4–5) 309-16, https://doi.org/10.1016/j.oraloncology.2008.06.002.
3. Globocan Cancer Today - World Glob. Cancer Obs. 2019.
4. Farmer P, Frenk J, Knaul FM, et al. Expansion of cancer care and control in countries of low and middle income: A call to action. Lancet. 2010; 376(9747): 1186-93. https://doi.org/10.1016/S0140-6736(10)61152-X.
5. Joshi P, Dutta S, Chaturvedi P, Nair S. Head and Neck Cancers in Developing Countries. Rambam Maimonides Med J. 2014; 5((2):e0009): 1-6. https://doi.org/10.5041/RMMJ.10143.
6. World Health Organization. Pathology and Genetics of Head and Neck Tumours. 2005.
7. Argiris A, Karamouzis MV, Raben D, Ferris RL. Head and neck cancer. Lancet. 2008; 371: 1695-709, https://doi.org/10.1016/S0140-6736(08)60728-X.
8. Chen YJ, Chang JTC, Liao CT, et al. Head and neck cancer in the betel quid chewing area: Recent advances in molecular carcinogenesis. Cancer Sci. 2008; 99(8): 1507-14, https://doi.org/10.1111/j.1349-7006.2008.00863.x.
9. Ouyang Y-H. Skin Cancer of the Head and Neck. Semin Plast Surg. 2010; 24(2): 117-26, https://doi.org/10.1055/s-0030-1255329.
10. Romesser PB, Riaz N, Ho AL, Wong RJ, Lee NY. Cancer of the Head and Neck. 2012; 1037-70, https://doi.org/}10.1016/B978-1-4557-2865-7.00068-0.
11. Erovic BM, Goldstein DP, Kim D, et al. Sebaceous gland carcinoma of the head and neck: The Princess Margaret Hospital experience. Head Neck. 2013; 35(3): 316-20, https://doi.org/10.1002/hed.22964.
12. Rettig EM, D'Souza G. Epidemiology of Head and Neck Cancer. Surg Oncol. Clin N Am. 2015; 24(3): 379-96, https://doi.org/10.1016/j.soc.2015.03.001.
13. Stewart B, Kleihues P. Human cancers by organ site World Cancer Rep. 2003; 232.
14. Korir A, Okerosi N, Ronoh V, Mutuma G, Parkin M. Incidence of cancer in Nairobi, Kenya (2004-2008). Int J Cancer. 2015; 137: 2053-59, https://doi.org/10.1002/ijc.29674.
15. Glick M, Johnson MW. Oral and oropharyngeal cancer: What are the next steps? J Am Dent Assoc. 2011; 142(8): 892-94, https://doi.org/10.14219/jada.archive.2011.0280.
16. Sekee TR, Burt FJ, Goedhals D, Goedhals J, Munsamy Y, & Seedat RY. Human Papillomavirus in Head and Neck Squamous Cell Carcinomas in a South African Cohort. Papillomavirus Res. 2018; 6: 58-62, https://doi.org/10.1016/j.pvr.2018.10.006.
17. Hille J, Johnson NW. The burden of oral cancer in sub-Saharan Africa. Transl Res Oral Oncol. 2017; 2: 1-13. https://doi.org/10.1177/2057178x17721094.
18. Ayo-Yusuf O, Lalloo R, Johnson N. Trends and ethnic disparities in oral and oro-pharyngeal cancers in South Africa (1992-2001). South African Dent J. 2013; 68(4): 168-73.
19. Jawad H, Hodson NA, Nixon PJ. A review of dental treatment of head and neck cancer patients, before, during and after radiotherapy: part 1. Br Dent J. 2015; 218(2): 65-8, https://doi.org/10.1038/sj.bdj.2015.28.
20. Lawrence M, Aleid W, McKechnie A. Access to dental services for head and neck cancer patients. Br J Oral Maxillofac Surg. 2013; 51(5): 404-7, https://doi.org/10.1016/j.bjoms.2012.10.004.
21. Matsuzaki H, Tanaka-Matsuzaki K, Miyazaki F, et al. The role of dentistry other than oral care in patients undergoing radiotherapy for head and neck cancer. Jpn Dent Sci Rev. 2017; 53(2): 46-52, https://doi.org/10.1016/j.jdsr.2016.09.003.
22. Schultz C, Goffi-Gomez MVS, Liberman PHP, Pellizzon AC de A, Carvalho AL. Hearing Loss and Complaint in Patients With Head and Neck Cancer Treated With Radiotherapy Arch Otolaryngol Head Neck Surg. 2010; 136(11): 1065-9, https://doi.org/10.1001/archoto.2010.180.
23. Frydrych A, Slack-Smith L, Park J, Smith A. Expertise Regarding Dental Management of Oral Cancer Patients Receiving Radiation Therapy Among Western Australian Dentists. Open Dent J. 2012; 6: 197-207, https://doi.org/10.2174/1874210601206010197.
24. McCaul L. Oral and dental management for head and neck cancer patients treated by chemotherapy and radiotherapy Dent Updat. 2012; 39(2): 135-8,140.
25. Mawardi H., Al-Mohaya M., Treister N. Oral health considerations in cancer survivors Saudi Med J. 2013; 34(5): 461-9.
26. Hartnett E. Integrating oral health throughout cancer care. Clin J Oncol Nurs. 2015; 19(5): 615-9, https://doi.org/10.1188/15.CJON.615-619.
27. Bertl K, Loidl S, Kotowski U, et al. Oral health status and dental care behaviours of head and neck cancer patients: a cross-sectional study in an Austrian tertiary hospital. Clin Oral Investig. 2016; 20(6): 1317-27, https://doi.org/10.1007/s00784-015-1618-x.
28. Mainali A, Sumanth K, Ongole R, Denny C. Dental consultation in patients planned for/undergoing/post radiation therapy for head and neck cancers: A questionnaire-based survey. Indian J Dent Res. 2011. https://doi.org/10.4103/0970-9290.93454.
29. Murphy BA, Deng J. Advances in Supportive Care for Late Effects of Head and Neck Cancer. J Clin Oncol. 2015; 33(29): 3314-21. https://doi.org/10.1200/JCO.2015.61.3836.
30. Turato ER. Qualitative and quantitative methods in health: Definitions, differences and research subjects. Rev Saude Publica. 2005; 39(3): 507-14, https://doi.org/10.1590/s0034-89102005000300025.
31. Guest G, Bunce A, Johnson L. How Many Interviews Are Enough?: An Experiment with Data Saturation and Variability Field methods. 2006; 18(1): 59-82, https://doi.org/10.1177/1525822X05279903.
32. Braun V, Clarke V. Using thematic analysis in psychology Qual Res Psychol. 2006; 3:2: 77-101, https://doi.org/http://dx.doi.org/10.1191/1478088706qp063oa.
33. Saunders B, Sim J, Kingstone T, et al. Saturation in qualitative research: exploring its conceptualization and operationalization Qual Quant. 2017; 1893-907, https://doi.org/10.1007/s11135-017-0574-8.
34. Cognetti DM, Weber RS, Lai SY. Head and Neck Cancer: An Evolving Treatment Paradigm Cancer. 2008; 113(70): 1911-32, https://doi.org/10.1002/cncr.23654.
35. Tulunay-Ugur OE, McClinton C, Young Z, et al. Functional Outcomes of Chemoradiation in Patients with Head and Neck Cancer. Otolaryngol Neck Surg. 2013; 148(1): 64-8, https://doi.org/10.1177/0194599812459325.
36. Varelas X, Kukuruzinska MA. Head and neck cancer: From research to therapy and cure. Ann NY Acad Sci. 2014; 1333: 1-32. https://doi.org/10.1111/nyas.12613.
37. Pateman KA, Ford PJ, Batstone MD, Farah CS. Coping with an altered mouth and perceived supportive care needs following head and neck cancer treatment. Support Care Cancer 2015; 23(8): 2365-73, https://doi.org/10.1007/s00520-015-2607-y.
38. Sheiham A. Oral health, general health and quality of life. Bull World Health Organ. 2005; 83(9): 644.
39. Bueno AC, Ferreira RC, Cota LOM, et al. Comparison of different criteria for periodontitis case definition in head and neck cancer individuals. Support Care Cancer. 2015; 23(9): 2599-604, https://doi.org/10.1007/s00520-015-2618-8.
40. Samim F, Epstein JB, Zumsteg ZS, Ho AS, Barasch A. Oral and dental health in head and neck cancer survivors. Cancers Head Neck. 2016. https://doi.org/10.1186/s41199-016-0015-8.

41. O'Brien KM, Timmons A, Butow P, et al. Associations between neighbourhood support and financial burden with un met needs of head and neck cancer survivors. Oral Oncol. 2017; 65: 57-64. https://doi.org/10.1016/j.oraloncology.2016.12.019.
42. Zaidi AA, Ansari TZ, Khan A. The financial burden of cancer: Estimates from patients undergoing cancer care in a tertiary care hospital. Int J Equity Health. 2012; 11: 60, https://doi.org/http://doi.org/10.1186/1475-9276-11-60.
43. Mesquita AC, Chaves ÉDCL, Avelino CCV, et al. The use of religious/spiritual coping among patients with cancer under going chemotherapy treatment. Rev Latino-Am Enferm. 2013; 21(2): 539–45, https://doi.org/10.1590/S0104-11692013-000200010.
44. Carvalho CC, Chaves E de CL, Iunes DH, et al. Effectiveness of prayer in reducing anxiety in cancer patients. Rev da Esc Enferm da USP. 2014; 48(4): 684-90, https://doi.org/https://dx.doi.org/10.1590/S0080-623420140000400016.
45. Ramphoma KJ. Oral Health in South Africa: Exploring the role of dental public health specialists. South African Dent J. 2016; 71(9): 402-3.
46. Singh S, Myburgh NG, Lalloo R. Policy analysis of oral health promotion in South Africa. Glob Health Promot. 2010; 17(1): 16-24. https://doi.org/10.1177/1757975909356631.
47. Bhayat A, Chikte U. The changing demographic profile of dentists and dental specialists in South Africa: 2002-2015. Int Dent J. 2017; 1-6, https://doi.org/10.1111/idj.12332.
48. Abed H, Reilly D, Burke M, Daly B. Patients with head and neck cancers' oral health knowledge, oral health-related quality of life, oral health status, and adherence to advice on discharge to primary dental care: A prospective observational study. Spec Care Dent. 2019; 39(6): 593-602, https://doi.org/10.1111/scd.12418.
49. Pai R, Ongole R. Nurses' Knowledge and Education about Oral Care of Cancer Patients Undergoing Chemotherapy and Radiation Therapy. Indian J Palliat Care. 2015; 21(2): 225-30, https://doi.org/10.4103/0973-1075.156507.
50. Ingram SS, Seo PH, Sloane R, et al. The association between oral health and general health and quality of life in older male cancer patients. J Am Geriatr Soc. 2005; 53(9): 1504-9, https://doi.org/10.1111/j.1532-5415.2005.53452.x.
51. Molete MP, Daly B, Hlungwani TM. Oral health promotion in Gauteng: a qualitative study. Glob Health Promot. 2013; 20(1) 50-8, https://doi.org/10.1177/1757975913476906.
52. Nemoto R, Victorino A, Pessoa G, et al. Oral cancer preventive campaigns: Are we reaching the real target? Braz J Otorhinolaryngol. 2015; 81(1): 44-9, https://doi.org/10.1016/j.bjorl.2014.03.002.
53. Mol RP. The role of dentist in palliative care team. Indian J Palliat Care. 2010; 16(2): 74-8. https://doi.org/10.4103/0973-1075.68408.
54. Yi Mohammadi J, Franks K, Hines S. Effectiveness of professional oral health care intervention on the oral health of residents with dementia in residential aged care facilities: a systematic review protocol. JBI Database Syst Rev. Implement Reports. 2015; 13(10): 110-22, https://doi.org/10.11124/jbisrir-2015-2330.
55. Dionne KR, Warnakulasuriya S, Zain RB, Cheong SC. Potentially malignant disorders of the oral cavity: Current practice and future directions in the clinic and laboratory. Int J Cancer. 2015; 136: 503-15, https://doi.org/10.1002/ijc.28754.
56. Petersen PE. World Health Organization global policy for improvement of oral health – World Health Assembly 2007. Int Dent J. 2008; 58: 115-21. doi:10.1111/j.1875-595X.2008.tb00185.x, https://doi.org/10.1922/IDJ_1930Petersen07.
57. Hertrampf K, Wenz HJ, Koller M, et al. Assessing dentists' knowledge about oral cancer: Translation and linguistic validation of a standardized questionnaire from American English into German. Oral Oncol. 2009; 45(10): 877-82, https://doi.org/10.1016/j.oraloncology.2009.02.010.

http://dx.doi.org/10.17159/2519-0105/2020/v75no7a2

Development of a tool to measure patient expectations with complete removable dentures

SADJ August 2020, Vol. 75 No. 7 p362 - p366

R Ahmed

ABSTRACT

Introduction

Patients' expectations of complete removable dentures may play a role in determining their level of satisfaction with newly constructed complete removable dentures.

Aims and objectives

To develop a Patient Expectation Questionnaire using a validated satisfaction questionnaire as framework and subsequently determine patients' expectations of complete removable dentures.

Objectives

1. To formulate a patient expectations questionnaire using a validated satisfaction questionnaire framework that will assesses their perceptions of new dentures.

2. To determine patient expectations related to masticatory functional, pain, psychological discomfort and social disability with complete removable dentures.

Methodology

All the aspects of the newly formed Patient Expectation Questionnaire (PEQ) was formulated following the framework of the OHIP-20 patient satisfaction tool. The expectation questionnaire was administered to patients at their first dental visit with the information sheet and informed consent form.

Results

A series of statistical tests was done to assess the validity and reliability of the Patient Expectation Questionnaire. These tests concluded that the newly formulated questionnaire was reliable.

Conclusion

Patient expectations can be determined prior to treatment thereby allowing the clinician to manage these expectations and strive to meet the attainable ones during the construction of the complete removable denture.

Author affiliations:
Rukshana Ahmed: *BChD; MSc (Dent),* Lecturer, University of the Western Cape, Western Cape, South Africa.
ORCID Number: 0000-0002-0286-9047
Address: University of the Western Cape
Private Bag X01
Tygerberg
7505
Email: rahmed@uwc.ac.za

Amongst others masticatory efficiency and pain were identified as being high on the request list for new complete removable dentures.

Keywords

Patient expectations, satisfaction, locus of control, complete dentures.

INTRODUCTION

The importance of meeting patients' expectations is a core objective in the management of edentulous patients. Ample research has been conducted around patient satisfaction and quality of life. Several studies have focussed on the factors influencing patient expectations in complete removable dentures (CRD).[1-4]

Expectation is defined as "a feeling of hope, being in a state of expecting, anticipation with confidence of fulfilment, and in some cases apprehension".[5] All of these emotions may be experienced by the edentulous patient prior to them getting a new set of dentures. In some cases, their experience with past or existing complete removable dentures (CRD) may also influence their expectations.[2,6] Determining pre-treatment expectations have the ability to affect the success of patient treatment outcomes whilst, failure may result from a misinterpretation of these perceptions and patient expectations. Compromises to treatment outcomes are readily accepted by patients when they have been included in the diagnosis and clinical decision-making.[6,7]

Patient expectations can be influenced by age, gender, levels of education and psychosocial factors.[3] Studies have reported on the premise that expectations are developed from experiences and are influenced by patients' existing knowledge regarding treatment.[13] Other studies have, however, refuted this indicating that perceptions regarding new CRD were not influenced by the level of education or previous denture experience.[13,16] This is in contrast with Lee et al, (2008) who investigated the influence of clinical variables on patients' perception and concluded education is a determining factor in expectations.

Many factors play an integral part in the psyche of the patient and understanding these factors will result in effective patient management.[1,8,9] The psychosomatic phenomenon, which is a combination of expectations, emotional and psychosocial factors, play a pivotal role in the patient's adaptation to his or her CRD.[10-14]

No studies have been able to show that personality traits influence patient expectation and satisfaction with dental treatment, however, it still warrants incorporating this into the holistic treatment of the edentulous patient.[10-12] Locus of control (LOC) is a theory in personality psychology which refers to the extent individuals believe that they can control events that causes positive or negative results in their lives.[10-12]

It is a measure of non-cognitive skills that can influence the manner in which the patient will attribute their own short comings or external factors and relate these to the clinician and to the success of their treatment. The development of LOC originates from past experiences, family and culture. The LOC can be further divided into Internal and External sources:[10,11]

i. Internal Locus of control

Patients with an internal LOC see the events of their life primarily as a result of their own actions and behaviour. These individuals have better control of their behaviour, actively seek knowledge concerning their situation and usually have a great belief in their success.

People with an internal LOC believe in controlling their destiny and relying on their personal skills and efforts. Literature shows that these individuals are part of families that place emphasis on education, responsibility and effort. Patients with a high internal locus of control tend to experience higher levels of satisfaction with the treatment they received because of the level of trust between patient and health care provider.[10-12]

ii. External Locus of control

Patients with an external LOC see the events of their life as circumstances out of their control. These individuals believe that fate, chance, luck or the influence of others are determining factors in their lives and usually do not have high levels of expectations and lack determination.[10-12] Patients with an external LOC tend to be more maladjusted than those in the internal groups.

Studies have concluded that the LOC is a useful tool in the prediction of human behaviour and that there is a relationship between internal and external LOC and patient adjustment. The study concluded that patients with an internal LOC adapt faster and tend to cooperate with a treatment plan, and are vocal about complaints and dissatisfaction.[15]

Bellini et al, (2009) conducted a study in which the effect of the type of LOC a patient exhibits and its influences on expectations as well as satisfaction was established.[17] These different profiles are verified using a validated questionnaire that contains questions regarding patient beliefs about the control of their lives. It was evident that patients with an external LOC would tend to blame the denture and the clinician for the dissatisfaction and would most likely request unnecessary adjustments.

Auerbach et al, (2004) conducted a study wherein the expectation of the study was that patients with an internal LOC would respond positively to being given autonomy in their treatment objectives and decision-making, while external LOC patients who theoretically have lower expectations would do better in the low control conditions.

The results of the randomized study showed there was no effect on meeting expectations regardless of being in the decision-making or none decision-making cohort.

In addition, this research confirmed that inter personal relationships between patients and clinician played a pivotal role in satisfaction and meeting the treatment objectives.[17] Open dialogue between clinician and patient and the involvement of the patient in treatment planning is instrumental in achieving a satisfactory experience for the patient.[18]

In previous patient expectation and complete denture studies, visual analogue scales (VAS) or specific questions were used to measure pre-treatment expectations.[17-20] In these studies, the focus was on aesthetics, masticatory function, phonetics and comfort.[5,7,17,18]

Similar questions were asked post-delivery of the CRD to assess satisfaction. In this way, the relationship between patients' expectation and satisfaction could be investigated. The results of the expectations investigation in these studies were used as base line indicators to determine what is important to the patient and allowed for a meaningful understanding for the dental practitioner when commencing treatment.

The most significant result of these studies showed a weak correlation between the patient's expectation and satisfaction with CRD in relation to aesthetics. It was interesting to note the expectation factor regarding aesthetics were higher for males than females.[18]

Based on the established research that the understanding of patient's expectations can positively influence the outcome of CRD treatment, the manner in which patient expectations are measured would be of interest.

The purpose of this research was to determine whether patients' expectations influenced their satisfaction with new complete dentures constructed by undergraduate dental students. The Oral Health Impact Profile-20 (OHIP-20) was used to measure patient's satisfaction with CRD and the newly formulated PEQ was used to measure expectations.

The OHIP was chosen as the preferred tool for measuring CRD satisfaction because the instrument was derived by patients and not clinicians. It is a subjective tool developed and validated by Slade and Spencer using the World Health Organisation framework to classify disabilities, handicaps and impairments.[13,20]

The OHIP-20 consisting of 20 questions which includes conceptual domains such as functional limitation, pain, psychological discomfort physical disability, psychological disability, social disability and handicap.

The responses are based on a Likert-type scale ranging from 0 to 4, and recorded as 'never' to 'very often'. The higher the OHIP score determined by the 5-point

Likert scale coded never (score 0), hardly ever (score 1), occasionally (score 2), fairly often (score 3) and very often (score 4), the more likely the patient has a poor oral health status.[19]

METHODOLOGY

The Patient Expectation Questionnaire (PEQ) was formulated by the principal researcher using the framework of the OHIP-20 by amending the questions in such a way that they would give insight into patient expectations. An example of how the questions were formulated is showed below in Table 1.

In doing so, it allowed for some correlations between the specific variables between this questionnaire and the follow up OHIP-20. The PEQ (Table 2) questions were based on conceptual subscales that related to; functional limitation, physical disability, physical pain, psychological disability and the handicap of the patient.

Table 1.

OHIP-20 Functional limitations subscale	PEQ Functional limitations subscale
1. Have you had difficulty chewing because of problems with your teeth/dentures?	1. Do you expect to have difficulty chewing because of problems with your dentures?
2. Have you had food catching in your teeth or dentures?	2. Do you expect to have food catching underneath your dentures?
3. Have you felt that your dentures have not been fitting properly?	3. Do you expect your dentures to fit retentively/properly?

Table 2. Patient Expectation Questionnaire (PEQ)

FL	1.	Do you expect to have difficulty chewing because of problems with your dentures?	Very Often	Fairly Often	Very Often	Fairly Often
FL	2.	Do you expect to have food catching underneath your dentures?	Very Often	Fairly Often	Very Often	Fairly Often
PD2	3.	Do you expect to avoid eating some foods because of problems with your new dentures?	Very Often	Fairly Often	Very Often	Fairly Often
PD2	4.	Do you expect your diet to change/ be unsatisfactory because of problems with your new dentures?	Very Often	Fairly Often	Very Often	Fairly Often
PD2	5.	Do you expect that you will be unable to eat with your new dentures?	Very Often	Fairly Often	Very Often	Fairly Often
PD2	6.	Do you expect to interrupt your meals because of problems with your new dentures?	Very Often	Fairly Often	Very Often	Fairly Often
PP	7.	Do you expect to pain in your mouth as a result of your new dentures?	Very Often	Fairly Often	Very Often	Fairly Often
PP	8.	Do you expect to have sore spots/ ulcers in your mouth because of your dentures?	Very Often	Fairly Often	Very Often	Fairly Often
PP	9.	Do you expect your new dentures to be uncomfortable? (if not applicable, please mark Never	Very Often	Fairly Often	Very Often	Fairly Often
PD1	10.	Do you expect to be self-conscious because of problems with your dentures?	Very Often	Fairly Often	Very Often	Fairly Often
FL	11.	Do you expect your dentures to fit retentively/ properly?	Very Often	Fairly Often	Very Often	Fairly Often
H	12.	Do you expect your dentures to affect your Quality of Life?	Very Often	Fairly Often	Very Often	Fairly Often
H	13.	Do you expect you will be satisfied with your new dentures?	Very Often	Fairly Often	Very Often	Fairly Often

Participants were asked to record their responses in one of five categories with the use of a Likert scale exactly the same as in answering the OHIP-20. For the questions on the PEQ with responses very often and fairly often, never and hardly ever were combined into one group as 'often' and 'never' to assess the impact on all variables. Since the PEQ was a new tool a series of statistical tests was done to assess the validity and reliability of it. Reliability tests were done on the questions that form the PEQ.

This was determined by using Cronbach's Alpha. A factor analysis was conducted as a data reduction technique to summarise the items loading under factors summarising the research instrument. A convenience sample of a 100 patients that were being treated for CRD by undergraduate students was used in this study. The PEQ was completed by the edentulous patient at the first dental visit and a frequency distribution was done on the data. This data was correlated with the results of OHIP-20 a few months later.

RESULTS

The results for the PEQ statistical tests include:

1. Cronbach's Alpha equalled to .773, which indicates a good reliability. Cronbach's Alpha between 0.7- 0.8 indicates acceptable α value, therefore the findings reveal that the scale was very reliable.

2. A factor analysis was conducted as a data reduction technique. In the process of validation a factor analysis yielded a four factor solution (Eigen values of extracted factors >1).

   The total variance of the four factors was 64.4%. Reliability for two of the identified factors yielded was conceptually stronger than the latter two and was disregarded from the analysis. These two factors were related to functioning (mastication) and pain.

The PEQ proved significant and reliable during the initial assessment of the patient. The structure of the PEQ made correlation between the expectation and satisfaction factor easy and allowed for deductions to be made. During the construction of CRD less emphasis placed on psychometric measures by clinicians due to lack of understanding.

Description of the frequency distribution of PEQ

Questions relating to Functional Limitations (FL)

- Majority of the sample (n=100) indicated that they never expected to encounter difficulty with chewing or have food catching as a result of the new CRDs.
- A large portion of the sample (87 %) did not expect their CRDs not to fit properly.

Questions relating to Physical Disability (PD 2)

- Majority (66.6%) of the sample felt that they would never avoid certain foods or feel that their diet would be unsatisfactory because of CRDs.

- In addition the largest part of the sample expressed an expectation to never be unable to eat or to interrupt their meals because of problems with the new CRDs.

Questions relating to Physical Pain (PP)

- About half of the sample expected to experience pain as a result of the new CRDs but this was not evident in relation to the satisfaction scores for this question.

- More than two thirds (64%) of the sample felt that their new CRDs would never be uncomfortable.

Questions relating to Psychological Discomfort (PD1)

- Less than half of the sample (44.5%) felt they would be self-conscious because of problems with their CDs.

Questions relating to Handicap (H)

- The greater part of the sample (95.5%) felt that their dentures would impact on their Quality of life and (97.8%) felt they would be satisfied with their new CRDs.

DISCUSSION

Reliability tests using Cronbach's Alpha was required in order to validate the PEQ. Cronbach's Alpha between 0.7- 0.8 indicates acceptable α value, therefore the findings reveal that the scale was very reliable.

Once the reliability was ascertained, factor analysis was conducted as a data reduction technique thereby removing redundancy or duplication from a set of correlated variables.

These factors were related to mastication and pain and cover the functional limitations and physical disability domains as identified in previous studies.[6,8] The analysis of the frequency distribution of the PEQ yielded high expectations in all the sub-sections of the questionnaire. High expectation was recorded for ease of mastication and lack of pain, however it can be deemed unrealistic to not have adaptation issues with the new CRD.[6,7,8]

A result that was noteworthy was that more than half of the sample felt they would be self-conscious as a result of problems with their new CRD.

The item quality of life showed a high level of expectation and there was a great expectation regarding satisfaction with new CRD.[7] The high levels of expectations can also be explained by the high percentage of females in the sample and since females tend to have higher expectation than male counterparts for aesthetics and function and tend to seek treatment for edentulism more readily.[22]

In addition to the above mentioned clinical aspects of patient expectations the fact that treatment was received at a teaching institution could influence the high levels of expectation perceived in this study.

CONCLUSION

This study allows for exploration of those factors in relation to edentulous patients and supported findings by other researchers in which factors such as aesthetics, function and pain were identified as the areas where patients expressed high levels of expectations.

Educating patients and spending sufficient time understanding the needs of patients play a fundamental role in meeting patient's expectations and a successful outcome.

Clinical significance

Pre-treatment planning and effective treatment planning is the foundation of successful dental treatment. Areas of high expectations can be modified or amended by using the PEQ. The PEQ allows for participation and understanding from both the dentist as well as the patient thus forging a common ground before actual treatment commences.

References

1. Zou Y, Zhan D. Patients' expectation and satisfaction with complete denture therapy before and after therapy. Vojnosanittetski Pregled. 2015; 72(6): 495-8.
2. Miranda BB, dos Santos MBF, Marchini L. Patients' perception of benefits and risks of complete denture therapy. American College of Prosthodontists. 2014; 23: 515-20.
3. Gaspar MG, Dos Santos MBF, Dos Santos JFF, Marchini L. Correlation of previous experience, patient expectation and the number of post-delivery adjustments of complete dentures with patient satisfaction in a Brazilian population. Journal of Oral Rehabilitation. 2013; 40: 590-4.
4. Douglass CW, Sheets CG. Patient's expectations for oral health care in the 21st century. J Prosthet Dent. 2000; 131: 3S-7S. (Oxford English Dictionary, British & World version 2013.
5. Marachilioglou CRMZ, Dos Santos JFF, Cunha VPP, Machini L. Expectation and final evaluation of complete dentures by patients, dentist and dental technician. J Oral Rehabil. 2010; 37: 518-24.
6. De Souza e Silva ME, de Magalhaes CS, e Ferreira EF. Gerodont. 2009; 26: 143-9.
7. Smith PW, McCord JF. What do patients expect from complete dentures? J Dent. 2004; 32: 3-7.
8. Cooper LF. The current and future treatment of edentulism. J Prosthodont. 2009; 18: 116-22
9. Petersen P.E, Kandelman D, Arpin S, Ogawa H. Global oral health of older people- call for public health action. Community Dental Health. 2010; 27: 257-68.
10. Fouda SM, Al-Attar MS, Virtanen JI, Raustia A. Effect of Patient's Personality on Satisfaction with Their Present Complete Denture and after Increasing the Occlusal Vertical Dimension: A Study of Edentulous Egyptian Patients. Journal of Dentistry Volume 2014, Article ID 635943, 7.
11. Erik Berglund, Per Lytsy, Ragnar Westerling.The influence of locus of control on self-rated health in context of chronic disease: a structural equation modelling approach in a cross sectional study. BMC Public Health. 2014; 14(492).
12. Janowski K, Kurpas D, Kusz J, Mroczek B, Jedynak T. Health- related behaviour, profile of health locus of control and acceptance of illness in patients suffering from chronic somatic diseases. www. Plosone.org. 2013; 8:e63920-e 63920.
13. Al-Omiri MK, Karasneh J. Relationship between oral health quality of life, satisfaction, and personality in patients with prosthetic rehabilitations. J Prosthodont. 2010; 19: 2-9.

14. Montero J, Macedo C, López-Valverde A, Bravo M. Validation of the oral health impact profile (OHIP-20sp) for Spanish edentulous patients. Med Oral Patol Oral Cir Bucal. 2012; May 1:17 (3):e469-76.
15. Lee SJ, Ahn SJ, Kim TW. Patient compliance and locus of control in orthodontic treatment: A prospective study. American Journal of Orthodontics and Dentofacial Orthopedics. 2008; 133: 354-8.
16. Kasilingam R, Sudha S. Influence of locus of control on investment behaviour of individual investor. Indian Journal of Management. 2010; 3: 17-25.
17. Auerbach SM, Penberthy AR, Kiesler DJ. Opportunity for control, interpersonal impacts and adjustment to a long-term invasive health careprocedure. Journal of Behavioural Medicine. 2004; 27: 11-29.
18. McCunniff M, Liu W, Dawson D, Marchini L. Patients' esthetic expectations and satisfaction withcomplete dentures. The Journal of Prosthetic Dentistry. 2017; 118(2): 159-65.
19. Pommer B. Use of the Oral Health Impact Profile (OHIP) in clinical Oral Implant Research. Journal of Dental, Oral and Craniofacial Epidemiology. 2013; 1: 3-10.
20. Bashayer Zaied and Salma A Saadaldin. "Influencing Factors on Patients' Expectation and Satisfaction with Complete Denture". EC Dental Science. 2016; 6(3): 1316-20.
21. Suresh S, Sharma S. A clinical survey to determine the awareness and preference of needs of a complete denture among complete edentulous patients. Journal of International Oral Health. 2010; 2: 65-70.

Do the CPD questionnaire on page 400

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.

Online CPD in 6 Easy Steps

1 Go to the SADA website www.sada.co.za.
2 Log into the 'member only' section with your unique SADA username and password.
3 Select the CPD navigation tab.
4 Select the questionnaire that you wish to complete.
5 Enter your multiple choice answers. Please note that you have two attempts to obtain at least 70%.
6 View and print your CPD certificate.

http://dx.doi.org/10.17159/2519-0105/2020/v75no7a3

The effect of A-dec ICX™ on microbiological water quality in self-contained dental units' water systems

SADJ August 2020, Vol. 75 No. 7 p367 - p372

SP Kgabi[1], SR Mthethwa[2]

INTRODUCTION AND BACKGROUND

The contamination of dental unit waterlines (DUWLs) as a result of biofilms that adhere to the inner surfaces of the lines continues to generate concern. The biofilm serves as a reservoir that can increase the number of free-floating microorganisms in the water used for dental treatment.

Recent studies found that it presents a confirmed but limited risk to immunocompetent individuals, but may pose a significant hazard for immunocompromised patients and dental professionals.[2-5] DUWLs are prone to biofilm formation because of their small diameter and water stagnation. Untreated or unfiltered dental unit water is likely to contain high numbers of microorganisms and is unlikely to meet standards for water used as a coolant/irrigant for nonsurgical dental procedures.[6]

Common approaches to improve water quality include self-contained water systems combined with periodic or continuous chemical treatment protocols, daily draining, air purging regimens, anti-retraction valves, point of use micro-filters, as well as flushing waterlines for several minutes in the morning and after every patient.[7,8]

Centralized systems designed for single chair or entire practice waterlines that purify or treat incoming water to remove or inactivate microorganisms are becoming more popular.[9]

In most dental settings, treatment water comes from the municipal water supply directly into the dental unit.

Author affiliations:
1. **Shamaka P Kgabi:** *BSc, BSc (Hons) MSc (Dent).,* Sefako Makgatho Health Sciences University, Pretoria, South Africa.
   ORCID Number: 0000-0003-0416-1808
2. **Sibusiso R Mthethwa:** *BDS, MPH, PhD.,* Sefako Makgatho Health Sciences University, Pretoria, South Africa.
   ORCID Number: 0000-0003-0420-808X

Corresponding author: Sibusiso R Mthethwa
Medunsa Campus, PO Box D24, Sefako Makgatho Health Sciences University, 0204, Pretoria, South Africa.
Email: rocky.mthethwa@smu.ac.za

Author contributions:
1. **Shamaka P Kgabi:** Conception; revising the article critically for important intellectual content - 50%
2. **Sibusiso R Mthethwa:** Project supervision; analysis and interpretation of data; drafting the article - 50%

Self-contained water systems, by contrast, isolate the dental unit from the municipal water supply. A bottle system affixed to the dental unit, in self-contained water systems, allow the clinician to better control the quality of water used in the dental treatment.[10] They also provide a way to introduce biofilm or microorganism-attacking chemicals into waterlines.

Without use of a chemical agent, however, self-contained systems do not reliably improve water quality.[11] Improperly maintained, a contaminated bottle system can worsen the microbiological quality of dental unit water.[10,11]

The disinfectant properties of the effervescent tablets of A-dec ICX™ have been assessed.[12-15] Their effectiveness in DUWL treatment protocol has been demonstrated in studies performed in simulated patient care settings as well as at dental treatment clinics. McDowell and colleagues (2004) found that A-dec ICX™ prevented biofilm formation in dental unit waterlines, reduced bacterial counts in incoming water and produced water quality exceeding stated recommendations of the American Dental Association (ADA) in a simulated clinical use study over a 16-week period.[12] Meiller and colleagues produced results which were consistent with those of McDowell over a 4-week period.[14] Independent studies at military hospitals in the USA and Malaysia by Bowen and colleagues (2015) and Siang Ma and colleagues (2015) respectively found that A-dec ICX™ reduced the bacterial load over a 5-week and 24-week periods respectively.[13,15]

At the oral health centre of Sefako Makgatho Health Sciences University (SMU), a dental school and a comprehensive care referral hospital in the outskirts of Pretoria, water flowing in dental units is mainly obtained from the municipal water supply. In early 2017, less than 10% (17/228) of the dental units had a self-contained water system that was separate from the municipal water.

No waterline treatment devices or chemical treatment protocols were being implemented. This study investigates the consistency of the reported association between the disinfection properties of the effervescent tablets of A-dec ICX™ and reduced bacterial counts in dental unit water at the oral health centre of SMU.

OBJECTIVES OF THE STUDY

To measure and compare mean bacterial counts in water samples collected from dental chairs which received pure distilled water only and those which received A-dec ICX™ tablet dissolved in distilled water.

MATERIALS AND METHODS

Design

This was a pre-test/post-test control group experimental design.

Target population

The study population consisted of seventeen dental units fitted with independent water system and used routinely to treat patients for 8 years with distilled water in clinics at the dental school of the Sefako Makgatho Health Sciences University in early 2017.

Sample size

Fourteen dental units were eligible to participate in the study. Three units that were not being used regularly for patient care were excluded from the study.

Allocation method

A sequence of random numbers was generated by a statistician using the computer software program SPSS (IBM, 2018).

The allocation sequence was concealed in a desktop computer until treatments were assigned by the supervisor. The random allocation rule was implemented i.e. a subset of the total sample size was randomly assigned by the research supervisor to group A (units which received distilled water only) and the remainder were assigned to group B (units which received A-dec ICX™ dissolved in distilled water).[16]

Blinding

Throughout the study period, the supervisor refilled two sterile twenty-five litres bottles labelled A and B with two levels of the treatment. The bottle labelled A contained pure distilled water. The distilled water in the bottle labelled B was prepared into a solution by dissolving one A-dec ICX™ tablet in 0.7 litre of pure distilled water.

The researcher (first author) monitored the water level in the dental units between clinic sessions and reported to the supervisor (second author) who replenished the supply of the allocated treatments daily. The researcher was blinded to group assignment of the units. All the dental units were observed throughout the study period to make sure there was no breakdown reported. The practice of flushing waterlines was not monitored.

Treatments

Seven dental units continued receiving pure distilled water while the remainder received A-dec ICX™ tablet dissolved in distilled water.

The primary outcome measured at the end of the five week follow up was the mean bacterial cfu/ml in water samples. The effect of interest was the difference in mean bacterial colony-forming units per millilitre (cfu/ml) between water samples collected from dental units which received two levels of the treatment. Repeat measurements of bacterial cfu/ml in water samples were performed for 20% of the samples.

Hypothesis

A-dec ICX™ reduces bacterial counts in dental unit waterlines.

Data collection

Water samples were collected from the dental chairs at baseline, the end of week 1 and at the end of week five. All samples reached the laboratory within 3 hours of collection and were processed appropriately upon arrival.

Water samples

100 ml water samples for aerobic cultures were collected from the distal outlets of the three-way air and water syringes into sterile bottles containing 0.1g of sodium thiosulfate to remove any residual disinfectant, after a 2 minute purge at the beginning of the workday before the dental unit was used.

Three, ten-fold serial dilutions (1:10, 1:100, and 1:1000) were prepared by adding 1 ml of each sample to 9 ml of sterile tap water in new sterile universal bottles.

Aliquots of 0.01 ml of each dilution was distributed evenly over the surface of sterile R2A agar plates using a sterile bent-glass rod (spread plate technique) and subsequently incubated at 28˚C for 96 hours.

Ethical considerations

The study protocol was approved by the Ethics Committee of Sefako Makgatho University (SMUREC/D/298/2016: PG). Permission to conduct the study was granted by the CEO of Medunsa Oral Health Centre.

STATISTICAL ANALYSIS/ HYPOTHESIS TESTING

Collected data were subjected to univariate analysis in} Statistical Package for the Social Sciences (SPSS) software. Measures of central tendency and dispersion were calculated.

ANCOVA was performed to evaluate whether the means of the dependent variable i.e. post-test (follow-up) mean bacterial cfu/ml measurement were equal across levels of a categorical independent variable i.e. the treatment group (pure distilled water = control, A-dec ICX™ tablet dissolved in pure distilled water = treatment), while statistically controlling for the effects of the covariate i.e. pre-test (baseline) mean bacterial cfu/ml. The level of significance was originally set at 0.05. Bonferroni correction was performed to counteract the problem of multiple comparisons.

A Bonferroni corrected/adjusted p value of 0.0083 was obtained by dividing the original α-value (0.05) by the number of analyses (6) on the dependent variable.[17]

Regression diagnostics was performed to evaluate the appropriateness of ANCOVA model. Two assumptions were checked to make sure that the covariate meets the requirements to run the ANCOVA.

These were: (1) independence of the covariate and treatment effect and (2) homogeneity of regression slopes. Interim analysis was performed at the end of week one.

RESULTS

Bacterial counts recorded from water samples collected from fourteen dental units were analysed. Figure 1 below is a flow diagram of the progress through the phases of the study (that is, enrolment, treatment allocation, follow-up, and data analysis).

The huge discrepancy in mean bacterial counts (24857.14 vs. 11142.86) indicate that the bacterial counts at baseline were not evenly distributed in the treatment groups. The mean bacterial count of the units was 18000 cfu/ml.

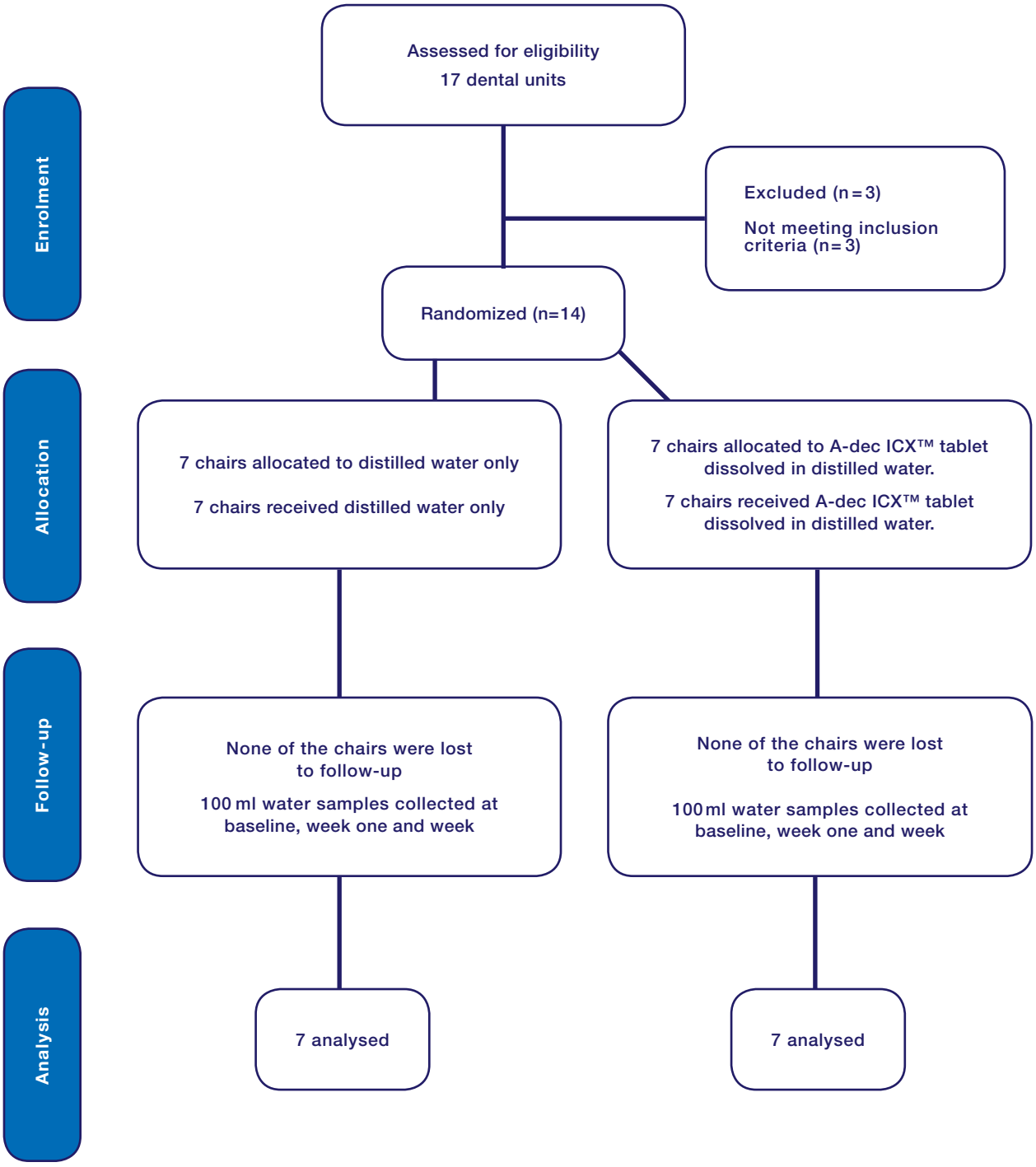


Figure 1. A flow diagram of the progress through the phases of the study (that is, enrolment, treatment allocation, follow-up, and data analysis).

Table 1. Bacterial counts at baseline.

Treatment	Sample sizes	Mean bacterial counts (CFU/ml)	Standard Deviation
Units randomized to receive distilled water only (Control)	7	11142.86	15388.617
Units randomized to receive A-dec ICX™ dissolved in distilled water (Treatment)	7	24857.14	35978.830
Both groups of units combined	14	18000	27520.622

INTERIM ANALYSIS AT THE END OF WEEK 1

Table 2. Independence of the covariate and treatment effect. (Dependent variable: Pre-test).

Source	Sum of squares	DF	Mean Square	F Value	Sig
Corrected Model	658285714.286a	1	658285714.286	.860	.372
Intercept	4536000000.000	1	4536000000.000	5.924	.032
Treatment Group	658285714.286	1	658285714.286	.860	.372
Error	9187714285.714	12	765642857.143		
Total	14382000000.000	14			
Corrected Total	9846000000.000	13			

R Squared = .067 (Adjusted R Squared = -.011).

There was insufficient evidence (p (0.860) > 0.0083) to reject the null hypothesis that the covariate (pre-test) was not different across the levels of the independent variable (treatment group) in the analysis.

Table 3. Homogeneity of regression slopes. (Dependent variable: Post-test).

Source	Sum of squares	DF	Mean Square	F Value	Sig	Partial Eta Squared
Corrected Model	425404391.612a	3	141801463.871	15.116	.000	.819
Intercept	43961068.823	1	43961068.823	4.686	.056	.319
Treatment Group	23098358.695	1	23098358.695	2.462	.148	.198
Pre-test	132109339.213	1	132109339.213	14.083	.004	.585
Treatment group * Pre-test	18685698.948	1	18685698.948	1.992	.188	.166
Error	93809894.102	10	9380989.410			
Total	965000000.000	14				
Corrected Total	519214285.714	13				

R Squared = .819 (Adjusted R Squared = .765).

The interaction effect between the covariate (pre-test) and independent variable (treatment group) in a model that includes the interaction between the covariate and independent variable was not significant (p (0.188) > 0.0083). This means that the regression slopes for the independent variable (treatment group) and covariate (pre-test) are similar.

There was insufficient evidence (p (0.391) > 0.0083) to reject the null hypothesis that the post-test mean bacterial cfu/ml were equal across levels of the treatment group when controlling for the covariate (pre-test).

Table 4. ANCOVA. (Dependent variable: Post-test).

Source	Type III Sum of squares	DF	Mean Square	F Value	Sig	Partial Eta Squared
Corrected Model	406718692.664a	2	203359346.332	19.885	.000	.783
Intercept	33222434.139	1	33222434.139	3.249	.099	.228
Pre-test	400932978.378	1	400932978.378	39.204	.000	.781
Treatment group	8144550.881	1	8144550.881	.796	.391	.068
Error	112495593.050	11	10226872.095			
Total	965000000.000	14				
Corrected Total	519214285.714	13				

R Squared = .783 (Adjusted R Squared = .744).

Table 5. Marginal mean. (Dependent variable: Post-test).

Group	Mean	Std. Error	Lower Bound	Upper Bound
Control	6432.436[a]	1230.171	3724.849	9140.024
Treatment	4853.278[a]	1230.171	2145.690	7560.866

a - Covariates appearing in the model are evaluated at the following values: Pre-test = 18000

Table 6. Independence of the covariate and treatment effect. (Dependent variable: Pre-test)

Source	Sum of squares	DF	Mean Square	F Value	Sig	Partial Eta Squared
Corrected Model	658285714.286a	1	658285714.286	.860	.372	.783
Intercept	4536000000.000	1	4536000000.000	5.924	.032	.228
Treatment group	658285714.286	1	658285714.286	.860	.372	.781
Error	9187714285.714	12	765642857.143			.068
Total	14382000000.000	14				
Corrected Total	9846000000.000	13				

R Squared = .067 (Adjusted R Squared = -.011).

At the end of week 1, the difference in mean bacterial cfu/ml between the control group and the treatment group was not statistically significant (p (0.391) > 0.0083 in **Table 6** above) when controlling for the covariate (pre-test).

ANALYSIS AT THE END OF WEEK 5

There was insufficient evidence (p (0.860) > 0.0083) to reject the null hypothesis that the covariate (pre-test) was not different across the levels of the independent variable (treatment group) in the analysis.

The interaction effect between the covariate (pre-test) and independent variable (group) in a model that includes the interaction between the covariate and independent variable was not significant (p (0.364) > 0.0083). This means that the regression slopes for the independent variable (treatment group) and covariate (pre-test) are similar.

There was a statistically significant difference (p (0.002) < 0.0083.) in the post-test mean bacterial cfu/ml across levels of the treatment group when controlling for the covariate (pre-test).

Table 7. Homogeneity of regression slopes (Dependent variable: Post-test)

Source	Sum of squares	DF	Mean Square	F Value	Sig	Partial Eta Squared
Corrected Model	92889898.830a	3	30963299.610	5.958	.013	.641
Intercept	62820598.614	1	62820598.614	12.088	.006	.547
Treatment group	42116109.344	1	42116109.344	8.104	.017	.448
Pre-test	10313770.104	1	10313770.104	1.985	.189	.166
Treatment group* Pre-test	4702941.091	1	4702941.091	.905	.364	.083
Error	51967244.027	10	5196724.403			
Total	296000000.000	14				
Corrected Total	144857142.857	13				

R Squared = .641 (Adjusted R Squared = .534).

Table 8. ANCOVA (Dependent variable: Post-test)

Source	Type III Sum of squares	DF	Mean Square	F Value	Sig	Partial Eta Squared
Corrected Model	88186957.739a	2	44093478.869	8.559	.006	.609
Intercept	75634105.682	1	75634105.682	14.681	.003	.572
Pre-test	5615529.167	1	5615529.167	1.090	.319	.090
Treatment group	88183301.431	1	88183301.431	17.117	.002	.609
Error	56670185.119	11	5151835.011			
Total	296000000.000	14				
Corrected Total	144857142.857	13				

R Squared = .609 (Adjusted R Squared = .538).

At the end of week 5, a statistically significant (p (0.002) < 0.0083 in **Table 8** above.) drop in mean bacterial cfu/ml from 5883.811 in the control group to 687.617 in the treatment group was estimated when controlling for the covariate (pre-test).

Table 9. Marginal means. (Dependent variable: Post-test).

Group	Mean	Std. Error	Lower Bound	Upper Bound
Control	5883.811[a]	873.122	3962.082	7805.540
Treatment	687.617[a]	873.122	-1234.111	2609.436

b - Covariates appearing in the model are evaluated at the following values: Pre-test = 18000

The 95% confidence interval of the difference in mean bacterial counts between the groups ranged from 2470.336 to 7243.964 cfu/ml. This confidence interval did not include zero, confirming the finding that the difference was statistically significant (p (002) < 0.0083).

DISCUSSION

This study was designed to determine the effect of A-dec ICX™ on bacterial counts in dental unit water. The results indicate that the baseline mean bacterial count was 18000 cfu/ml (SD 27520.622 cfu/ml) (**Table 1**). This bacterial count far exceeded the Centers for Disease Control and Prevention (CDC) and European Union's standard for water quality used in non-surgical dental procedures.

The results were however consistent with those of other studies which assessed bacterial counts in dental units which used distilled water alone. Marais and Brozel (1999) reported bacterial counts ranging from 3x104 - 2 x 105 cfu/ml from chairs at the University of Pretoria's Department of Oral Medicine and Periodontology, that had been in use for twelve years.[18]

Schmidtke found bacterial counts approximating 240000 cfu/ml in twelve chairs in the orthodontic clinic at the Department of Orthodontics, University of Alabama at Birmingham School of Dentistry, Birmingham, Alabama.[19] The findings of the current and cited previous studies was not unexpected. Kettering and Stephens (2002) demonstrated that distilled water alone cannot reduce microbial contamination of dental treatment water to the 200cfu/ml ADA stated goal.[20] The Organization for Safety, Asepsis and Prevention (OSAP) recommends using distilled water combined with periods of continuous application of chemicals.[10,11]

The results of this study showed a huge discrepancy in mean bacterial counts at baseline between the treatment groups (**Table 1**). This was not unexpected. The small sample size accounted for the large chance difference observed following randomization.[21]

The results of the regression diagnostics showed that the data satisfied the underlying assumptions inherent in the ANCOVA model (**Tables 2, 3, 6** and **7**). They confirmed that the ANCOVA model was the appropriate analysis for this study - consequently, the validity of the conclusions drawn could be relied upon.

The results of the interim analysis study showed that the mean bacterial counts in both group of units decreased, more so for the group of units which received A-dec ICX™ dissolved in distilled water (**Table 5**). The decrease was however not statistically significant (**Tables 4**).

This result may be explained by the fact that the mean difference in bacterial counts between the groups at baseline was huge relative to that measured at week one. These findings suggest that A-dec ICX™ tablets improved water quality. They support the OSAP recommendation that distilled water should be combined with periods of continuous application of chemicals.[10,11]

This experiment found substantial evidence (p (0.002) < 0.0083.) to reject the null hypothesis that the post-test mean bacterial cfu/ml were equal across levels of the treatment group when controlling for the covariate (pre-test) i.e. the difference in mean bacterial cfu/ml between units which received A-dec ICX™ dissolved in distilled water and those which received distilled water only was statistically significant (**Tables 8** and **9**).

This study produced results which corroborate the findings of a great deal of the previous research in different settings.[12-15] There are several possible explanations for the failure of treated distilled water to reduce bacterial counts to levels recommended by the ADA and CDC.

These include among others, the contamination of water sample by detachment of biofilm from the inner surface

of the dental tubing, the extremely high bacterial count prevalent at baseline and the relatively short study period of five weeks.

The current study found that the 95% confidence interval of the difference in mean bacterial counts between the groups ranged from 2470.336 to 7243.964 cfu/ml (Table 10). The upper and lower limits of the confidence interval indicate that the true difference was large and practically significant.

The wide confidence interval however indicates that the estimate of the mean difference was not precise. A wide confidence interval results from a small sample and/or data with substantial variability, and is a suggestion of low power.[22]

Limitations of the study

The flushing of the waterlines in the morning, at the end of the day, and between patients was not monitored. This was a source of potential imprecision in the measurement of the effect of interest.

Waterline flushing has been reported to improve water quality.[23-25] Cobb and colleagues (2002) found evidence that time-dependent waterline flushing produced a statistically significant reduction in planktonic bacteria.[26]

The failure to monitor waterline flushing in this study could not have distorted the estimate of the reduction in bacterial counts between water samples collected from dental units which received A-dec ICX™ dissolved in distilled water and those which received distilled water only as the users of the dental units were blinded to group assignment of the units.

CONCLUSION

A-dec ICX™ reduced bacterial counts in dental unit waterlines.

References

1. Lauritano D, Nardone M, Gaudio RM, Candotto V, Carinci F. Risk assessment of colonization of legionella spp. in dental unit waterlines. Oral Implantol. - Rome. 2017; 10(3): 283-8.
2. Mills SE. The dental unit waterline controversy: defusing the myths, defining the solutions. J Am Dent Assoc. 2000; 131(10): 1427-41.
3. Ricci ML, Fontana S, Pinci F, et al. Pneumonia associated with a dental unit waterline. Lancet. 2012; 379(9816): 684.
4. Barbot V, Robert A, Rodier MH, Imbert C. Update on infectious risks associated with dental unit waterlines. FEMS Immunol Med Microbiol. 2012; 65(2): 196-204.
5. Weissfeld, A.S. Infection Control in the Dental Office. Clin Microbiol Newsletter. 2014; 36(11): 79-84.
6. Organization for Safety, Asepsis and Prevention. Dental Unit Water Quality: OSAP White Paper and Recommendations. 2018; Available:https://cdn.ymaws.com/www.osap.org/resource/resmgr/annual_conf_2018/handouts/osap.duwl.whitepaperedits.mi.pdf Accessed [05 March 2019].
7. Centers for Disease Control and Prevention. Infection Prevention & Control in Dental Settings. 2019; Available at: http://www.cdc.gov/OralHealth/infectioncontrol/index.html Accessed [05 March 2019].
8. Szymanska J. Control methods of the microbial water quality in dental unit waterlines. Ann Agric Environ Med. 2003; 10(1): 1-4.
9. USAF Dental Evaluation & Consultation Service. Synopsis of Dental Unit Waterline Treatment Products and Devices. (Project 09-07) (9/09). Available: https://www.crosstex.com/sites/default/files/public/usaf-study.pdf. Accessed [05 March 2019].
10. Organization for Safety, Asepsis and Prevention. Biofilm and Dental Unit Waterlines. 2003 CDC guidelines expand dental worker responsibilities for treatment water quality. Infection Control in Practice. 2004; 3(2): 1-5.
11. Organization for Safety, Asepsis and Prevention. Dental Unit Waterlines: Questions and Answers. Available: https://www.osap.org/page/Issues_DUWL_1. Accessed [05 March 2019].
12. McDowell JW, Paulson DS, Mitchell JA. A simulated-use evaluation of a strategy for preventing biofilm formation in dental unit waterlines. J Am Dent Assoc 2004; 135(6): 799-805.
13. Bowen CG, Greenwood W, Guevara P, Washington MA. Effectiveness of a dental unit waterline treatment protocol with A-Dec ICX and Citrisil disinfectants. Military Medicine 2015; 180(10): 1098-1104.
14. Meiller TF, Kelley JI, Zhang M, DePaola LG. Efficacy of A-dec's ICX dental unit waterline treatment solution in the prevention and treatment of microbial contamination in dental units. J Clin Dent. 2004; 15(1): 17-21.
15. Siang MM, Zalini Y, Ahmad R, Zukri A, Farizah AF. A comparison of different disinfectants on the microbiological quality of water from the dental unit waterlines of a military hospital. Sains Malaysiana. 2015; 44(2): 187-92
16. Schulz KF, Grimes DA. Generation of allocation sequences in randomised trials: chance, not choice. The Lancet. 2002; 359: 515-9.
17. Chen SY, Feng Z, Yi X. A general introduction to adjustment for multiple comparisons. J Thorac Dis. 2017; 9(6): 1725-9.
18. Marais J.T, Brozel, V.S. Electro-chemically activated water in dental unit water lines. Br Dent J. 1999; 187: 154-8.
19. Schmidtke DW. Efficacy of Sterisil in the treatment of dental unit waterlines [Thesis]. University of Alabama at Birmingham. 2011; Available: https://static1.squarespace.com/static/5528a5d7e4b0f89b5fecbc38/t/58ab73cd3a0411800f241112/1487631310570/Alabama+Student+Study+Puretube+and+bottle.pdf. Accessed [05 March 2019].
20. Kettering JD, Munoz-Viveros CA, Stephens JA, Naylor WP, Zang W. Reducing bacterial counts in dental unit waterlines: distilled water vs antimicrobial agents. J Calif Dent Assoc 2002; 30: 735-41
21. Petrie A, Sabin C. Clinical trials. Medical statistics at a glance. 2nd ed. Massachusetts: Blackwell Publishing, 2005; 34-6.
22. Petrie A, Sabin C. Errors in hypothesis testing. Medical statistics at a glance. 2nd ed. Massachusetts: Blackwell Publishing, 2005: 44-5.
23. Pankhurst CL, Johnson NW, Woods RG. Microbial contamination of dental unit waterlines: the scientific argument. Int Dent J. 1998; 48: 359-68.
24. Venkatesh VK, Vidyashree NV, Parameswaran VA, et al. 2006. Evaluation of bacterial contamination of dental unit water Lines and the efficacy of a commercially available disinfectant. J Conserv Dent. 2006; 9: 93-8.
25. Watanabe E, Agostinho AM, Matsumoto W, et al. Dental unit water: bacterial decontamination of old and new dental units by flushing water. Int J Dent Hyg. 2008; 6(1): 56-62.
26. Cobb CM, Martel CR, McKnight SA 3rd, Pasley-Mowry C, Ferguson BL, Williams K: How does time-dependent dental unit waterlines flushing affect planktonic bacteria levels? J Dent Educ. 2002; 66: 549-55.

http://dx.doi.org/10.17159/2519-0105/2020/v75no7a4

The 'Digital Access Divide' at a South African Dental School – A cross-sectional study - Part 1

SADJ August 2020, Vol. 75 No. 7 p373 - p376

TC Postma[1], LM Sykes[2], A Uys[3], P Brandt[4], E Crafford[5]

ABSTRACT

This study sought to investigate the digital divide, from an access perspective, of dental students at the University of Pretoria. Second to final year students (n= 218 (87.2% response rate) completed a custom-designed survey at the end of 2017.

The investigation enquired about the digital devices and infra-structure they owned and used for study purposes. They were also asked to reveal the networks and resources they used to access online platforms and to comment on any other related access issues such as the quality of the Internet, speed and reliability, as well as cost and personal implications related to usage.

A clear divide could be detected for a minority of students (±1/7). Individually targeted interventions will be required to ensure an equitable and fair online learning experience.

INTRODUCTION

Government influence on Universities has led to the massification of higher education around the world,[1] with a coinciding drive towards online teaching and learning.[2]

Author affiliations:
1. **Thomas C Postma:** *MChD, DHSM, PhD,* Head Clinical Unit, Department of Dental Management Sciences, University of Pretoria, Pretoria, South Africa.
2. **Leanne M Sykes:** *BSc, BDS, MDent, IRENSA, Dip Forensic Path, Dip ESMEA,* Head of Department of Prosthodontics, University of Pretoria, Pretoria, South Africa.
   ORCID Number: 0000-0002-2002-6238
3. **André Uys:** *B.Sc., BChD. Dip.Odont. (Materials), Dip. Odont. (Endo), M.Sc. (Odont.), PhD,* Department of Oral Pathology and Oral Biology, Faculty of Health Sciences, University of Pretoria, Gauteng, South Africa.
4. **Paul Brandt:** *BChD (Stell), MSc (Odont), Adv Dip Aesthet Med (FPD),* Department of Restorative Dentistry, University of Pretoria, Pretoria, South Africa.
5. **Elmine Crafford:** *BChD, BChD Hons, Oral Medicine, MChD OMP,* Senior Specialist Department of Oral Medicine and Periodontics, University of Pretoria, Pretoria, South Africa.

Corresponding author: Leanne M Sykes
Head of Department of Prosthodontics, University of Pretoria, Pretoria, South Africa.
Email: leanne.sykes@up.ac.za

Author contributions:
1. **Thomas C Postma:** First author - 40%
2. **Leanne M Sykes:** Second author - 30%
3. **André Uys:** Third author - 10%
4. **Paul Brandt:** Fourth author - 10%
5. **Elmine Crafford:** Fifth author - 10%

This move has also been associated with beliefs that the mere exposure to technology is not enough and that deeper know-how of information technology-use is required to adequately equip graduates for the labour market in future.[3]

Access to information through digital technology, unfortunately remains a key challenge for many disadvantaged students in higher education in South Africa, with many relying on university loaned devices[4] and these days, zero-rated data (subsidised data).

Exposure to unreliable information and inadequate Internet speed are further factors that may result in negative digital learning experiences.[5] Obviously socio-economically disadvantaged individuals will have less access to necessary resources to succeed, which unfortunately may have a distinct impact on graduate unemployment rates.[6] This is particularly true in South Africa, where there is indeed a noticeable digital divide driven by social dynamics and inequality.[7]

This situation has been exacerbated by the sudden outbreak of the COVID-19 pandemic with governments and education institutions rushing into an expedited push towards online teaching and learning.[8]

Dental Schools are being faced by this same conundrum of adopting online teaching and learning strategies, which have until now not been often employed, due to the predominant clinical nature of the programme. The question, however is whether all students have equal access to online resources in order to ensure equitable teaching and learning?

Hence, the objectives of this study were to determine the information technology resources students possessed and used for learning purposes as well as their access and experiences with the quality of access to the Internet.

It also sought to investigate cost implications and perceived impact this had on disadvantaged students.

MATERIALS AND METHOD

Study design and sample

This cross-sectional investigation took the form of descriptive research, based on a custom-designed survey, which was given to all dental students from the second

to the fifth year of study. It was conducted at the School of Dentistry, University of Pretoria late in 2017. All registered students (the estimated number of ±60 students per year = sample size of 240 responses) were requested to participate in the survey and assured that all questionnaires would remain anonymous and all comments be kept strictly confidential.

Students who were concerned that they may be disadvantaged with their studies due to difficulties accessing the Internet were encouraged to discuss their problems further with their class tutors or the researchers.

* First year students were omitted due to their limited exposure to internet usage at University level.

Questionnaire

Students were asked to indicate their year of study (from year 2 to 5), sex, and where they resided (rented flats, residences, communes, parent's homes or other). They were then questioned on whether they had a computer/laptop, tablet/I-pad, or a smart phone and whether they possessed their own information technology and Internet hardware facilities, had a data contract and if so, the monthly cost thereof (2017 rates), as well as their general monthly data expenditure.

Usage of the local municipal-provided Tshwane network was probed, and students had to rate the Tshwane as well as the University data networks on a scale of zero ten (0 = very unreliable, 10 = strong reliability).

Those who used the Tshwane network were asked if the felt safe in the spaces where they accessed this network. Students were also asked whether they had access to the Internet for study purposes (specifically) at home, whether the Internet was easily accessible to them and whether they could access the Internet when they needed it the most ("Yes" or "No").

This was followed by a request to elaborate on any of the questions where they had given negative answers through open-ended inquiry. Further questions related to the frequency of use of the University computer facilities (daily, weekly, monthly, semesterly or never), as well as to indicate if they had to wait for a turn to use these facilities at the University and their residences.

This was followed by a question that sought to determine if the Internet speed, that they had access to, was acceptable to ensure efficient use, and to elaborate more if they indicated "No".

Students were asked about their studying preferences and whether they learnt directly from the computer/laptop, tablet/I-pad or smart-phone or if they printed downloaded materials for study purposes, and the cost thereof.

They were also probed as to whether they felt disadvantaged, compared to their classmates, due to lack of Internet access, or due to a lack of computers, tablets/I-pads and smartphones. In addition, they were asked to report if they have confided to lecturers about these issues and whether they had been helped by the lectures.

The questionnaire also contained questions about technology usage and perceived competencies in this regard. These questions were beyond the scope of the current report and will be reported on in a follow up paper.

The data was manually captured in Microsoft Excel and checked for accuracy by the second researcher. This was followed by a descriptive account, using frequency distributions of the responses. Relevant quotations were extracted, based on observed patterns, identified by the primary and second researcher.

RESULTS

A total of 218 dental students responded to the questionnaire, which constitutes a total response rate of 87.2%. It should be noted that not all student answered all the questions, hence the reported percentages below will not be a reflection of the 218 (total) responses, but rather of those who responded to each question.

Of the total respondents, 60 (27.6%), 54 (24.9%), 52 (24.0%) and 51(23.5%) were in the second to the fifth year respectively, with 73.6% being female. Respondents resided in rented flats (36.9%), University residences (32.2%), parents' homes (16.6%), communes (10.1%), and "other" housing options (4.1%) (**Figure 1**).

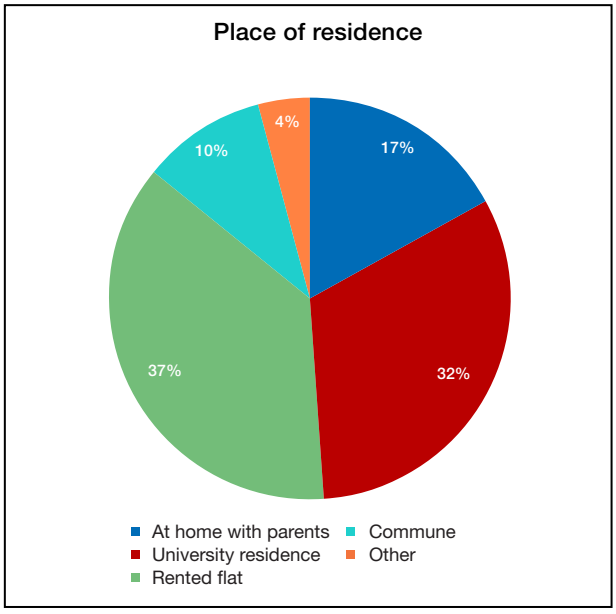


Figure 1. Place of residence.

Only seven students (3.2%) reported that they did not have a personal computer/laptop, while 85 (39%) did not possess a tablet/I-pad. Six (2.8%) students indicated not owning a smartphone.

Furthermore, 156 (71.6%) reported to have access to their own IT and Internet facilities of which the mean cost was R434 per month (p/m) (Standard deviation (SD): R269 p/m; Standard Error (SE) R27 p/m; 95% Confidence Interval (CI): R379-488 p/m (n=97)).

A total of 134 (61.5%) had a data contract with a mean cost of R362 p/m (SD: R237 p/m; SE R23 p/m; 95% CI: R317-406 p/m (n=110)), while spending on data

constituted R397 p/m (SD: R300 p/m; SE R25 p/m; 95% CI: R347-447 p/m (n=140)). At least 35 respondents (16.1%) made use of Tshwane free Wi-Fi, of which 16 stated that they did not feel safe in the spaces where this Wi-Fi was available. Using a scale of zero to ten, Tshwane Wi-Fi users rated the mean reliability of this network to be 5.45 (SD: 2.61; SE 0.48; 95% CI: 4.47-6.43 (n=30)). Comparatively, the University network was rated as 7.02 (SD: 1.69; SE 0.12; 95% CI: 6.79-7.25).

At least, 28 (12.9%) respondents reported to use University computers on a weekly basis or less, while 97 (44.6%) only use it only occasionally in a year. Of these 72 (33%) reported that they had to wait for a turn to use the computer facilities on campus while 24 (11%) had to wait their turn at residences or at home.

Sixty (27.5%) students did not have access to the Internet, specifically for study purposes, at their flats or private homes, while 27 (12.4%) indicated that they did not have easy access to the Internet at all.

A total of 25 (11.5%) respondents indicated a lack of access to the Internet when needed most. Some related qualitative comments included:

- "I do not have internet connection where I am residing, I don't have Wi-Fi or data either".
- "Where I stay there is no Wi-Fi and I have to choose between food and necessary data with my pocket money".
- "Data is expensive. Thus, not easy to top up all the time - have to come to campus to download work"
- "No Wi-Fi at private flat. If I need to use the internet, I must visit the internet café"
- "It's expensive and the network in my area is POOR (non-existent)".

Moreover, 44 (20.2%) respondents reported that the Internet resources they had access to had inefficient speed. Some of these were qualitatively specified as privately owned resources as well as University facilities on campus and at residences. Emerging quotes is this regard include:

- "Speed of internet has stopped me from watching educational videos due to waiting for it to load"
- "Is a bit slow sometimes = difficult to download notes"
- "Downloading documents such as PowerPoint presentations can take longer thus more use of data"
- "It is slow or offline sometimes"
- "Sometimes very slow. Disconnect suddenly, especially during tests"

Respectively, 162 (75.7%), 101 (46.3%), and 82 (37.6%) respondents indicated to be studying material directly from their computer, tablet/I-pad or smart phone while 128 (58.7%) downloaded and printed material for study purposes.

The average cost of the printing was reported to be R177 p/m (SD: R251 p/m; SE R29 p/m; 95% CI: R120-234 p/m (n=77)).

A total of 32 students (14.7%) felt disadvantaged compared to their classmates due to lack of Internet access while 25 (11.5%) felt disadvantaged due to a lack of computers, tablets/I-pads or smartphones.

Only 14 of them had confided to lecturers about their problems of not having easy access to the Internet or computers, but none of them had been helped in this regard.

DISCUSSION

This study aimed to determine the information technology resources dental students possessed for study purposes, and to gauge their experiences with access and quality of online learning, including cost-implications and personal implications.

The results showed that a very high percentage of dental students owned mobile digital devices (96.8% owned a computer/laptop and 97.2% owned a smartphone). These high numbers are consistent with trends reported in the literature that suggest that more and more students from lower socio-economic groups own digital devices in countries such as South Africa.[3]

Unfortunately, the mere possession of a devise does not guarantee access or quality access to the digital world,[7] which was evident in some of the results and comments. Obviously, students with devises had unlimited access on-campus to the relatively reliable University of Pretoria Wi-Fi network (Rated 7.02/10.00).

The big divide, however, became evident off campus where it was observed that 156 students could afford their own Internet infrastructure at home, at a fair cost, while 35 students often had to rely on the municipally provided Tshwane Wi-Fi network. Not only was the latter network rated less reliable (rated 5.45/10.00) compared to the university network, but nearly half of those who had to use the Tshwane network felt unsafe in the spaces where they could access the network.

Of these, 28 (12.9%) respondents used library computer on a daily/weekly basis. Thirty three percent of those who made used of the library computers had to wait their turn compared to only 11% at home. This is particularly relevant in the heavily loaded Dentistry programme that allows for little free time for research and self-study and clearly favours those with personal facilities at home.

Perhaps two of the most revealing results were that sixty students (27.5%) did not have access to the Internet, specifically for study purposes, at their flats or private homes and that 25 respondents (11.5%) indicated a lack of access to the Internet when they needed it the most.

Some indicated that they often did not have data and if they had to choose between data and food the choice was obvious. They then downloaded material when on campus or at Internet café's which has obvious dis advantages. Others have data but have a poor or no network where they reside, and complained that it often took too long to download.

The high monthly cost of data (R397 p/m based on 2017 data fees) reported in this study can fortunately now be negated because students are now being helped by being provided with zero-rated data for study purposes through the University's education management system hosted on Blackboard LearnTM. It should be borne in mind that these costs are subsidised by the University and may indirectly impact on students at a later stage through fee increases.

Another revealing result was that one in five students had issues with the quality of the signal or bandwidth both on and off campus resulting in situations where they could not properly access tests, videos and documents in reasonable time, and sometimes not at all.

Based on the results above it, is not surprising that a total of 32 (14.7%) students felt disadvantaged compared to their classmates due to lack of Internet access and 25 (11.5%) felt disadvantaged due to a lack of computers, tablets/I-pads or smartphones. It also appears that up until now, confiding in lecturers has not helped them solve the problem.

Limitations

The cross-sectional data is reflective of the period in which the survey was carried out. It is, however, unlikely that teaching and learning methods and information technology use changed much until the start of the COVID-19 lockdown in March 2020.

A bigger divide may however be detected if this study is repeated in the COVID-era. Students were sent home during lockdown with many students relying on favourable infrastructure in residences and on university campuses.

The fact that only 87.2% of students responded may have skewed the results slightly but we feel confident that it is a representative sample. The students of the University of Pretoria may also be more affluent compared to other student populations which may explain the relatively small number (±1/7) with access issues.

CONCLUSION

The results of this study revealed that not all students had equal access to the Internet and online learning opportunities. Many struggled to use it at times or in venues that suit their living conditions and intensive curriculum programs. In addition, a number of students were further disadvantaged due to the high costs of data although this has now partially been addressed with the zero-rating of data on the University education management system.

Management and lecturers need to be aware of this to ensure that no students are disadvantaged in comparison to their peers, nor erroneously labelled "disinterested" or "lethargic". Now more than ever they need to work together, to seek individual targeted solutions, and to implement the necessary changes if they wish to be truly committed to the well-being and education of their students.

References

1. Mok KH. Massification of higher education, graduate employment and social mobility in the Greater China region. British Journal of Sociology and Education. 2015; 37(1), 51-71.
2. Devlin M, McKay J. Teaching inclusively online in a massified university system. Widening Participation and Lifelong Learning. 2018 Jan 31; 20(1):146-66.
3. Ng'ambi D, Brown C, Bozalek V, Gachago D, Wood D. Technology enhanced teaching and learning in South African higher education - A rearview of a 20 year journey. British Journal of Educational Technology. 2016 Sep; 47(5): 843-58.
4. Nyahodza L, Higgs R. Towards bridging the digital divide in post-apartheid South Africa: a case of a historically disadvantaged university in Cape Town. South African Journal of Libraries and Information Science. 2017 Jan 1; 83(1): 39-48.
5. Porter WW, Graham CR, Bodily RG, Sandberg DS. A qualitative analysis of institutional drivers and barriers to blended learning adoption in higher education. The internet and Higher education. 2016 Jan 1; 28: 17-27.
6. Baldry K. Graduate unemployment in South Africa: Social inequality reproduced. Journal of Education and work. 2016 Oct 2; 29(7): 788-812.
7. Bornman E. Information society and digital divide in South Africa: results of longitudinal surveys. Information, Communication & Society. 2016 Feb 1; 19(2): 264-78.
8. Wajdi MB, Kuswandi I, Al Faruq U, Zulhijra Z, Khairudin K, Khoiriyah K. Education Policy Overcome Coronavirus, A Study of Indonesians. EDUTEC: Journal of Education And Technology. 2020 Mar 30; 3(2): 96-106.

http://dx.doi.org/10.17159/2519-0105/2020/v75no7a5

Dental students' self-perceived competency and usage of the internet for learning and evaluation purposes - Part 2

SADJ August 2020, Vol. 75 No. 7 p377 - p381

LM Sykes[1], TC Postma[2], A Uys[3], P Brandt[4], E Crafford[5]

ABSTRACT

Many dental lecturers are moving away from providing hand-out notes to their students and are rather opting for posting lecture material and tutorials on the internet using the various university platforms such as *clickUP*.

At the same time a number of students have queried the need to purchase the prescribed text books due to their high costs, and dated content. The presumption is that all students have unrestricted and equal access to this material, and are competent using digital technology for learning and assessment, however there has been no formal investigation into whether this is so.

Student access and usage was reported on in Part I of this study. The present paper investigated students' preferences with regards to the mode of learning material, and their self-perceived competencies in using the internet for various academic purposes. The project took the form of an anonymous, structured questionnaire that was given to all dental students from the second to the fifth year of study.

Results revealed that over 90% of the students feel competent to access and use internet search engines for research and assignments, to connect with friends, and to download or watch videos. Slightly less (between 70-90%) were confident using it for independent research, learning from lecture material, using e-dictionary, carrying out searches to learn extra material, completing short quizzes and assignments, or undertaking independent learning and reading.

Almost all students needed to access the internet on a daily or weekly basis for work related issues, yet at least 40% reported to not being able to do so at times or in venues that suited their programs. Lecturers need to be aware of this to ensure these students are not disadvantaged in comparison to their peers if they do not submit requisite material on time.

The university has pledged their commitment towards changing traditional teaching methods and embracing more blended learning platforms, as well as to helping students make up for the lost time due to the Corona virus pandemic. However, now more than ever they need to work together to ensure that all students have the necessary skills and technology needed to use the online platforms, and to provide the necessary tuition and changes if they wish to be truly committed to the well-being and education of their students.

Author affiliations:

1. **Leanne M Sykes:** *BSc, BDS, MDent, IRENSA, Dip Forensic Path, Dip ESMEA,* Head of Department of Prosthodontics, University of Pretoria, Pretoria, South Africa.
   ORCID Number: 0000-0002-2002-6238
2. **Thomas C Postma:** *MChD, DHSM, PhD,* Head Clinical Unit, Department of Dental Management Sciences, University of Pretoria, Pretoria, South Africa.
3. **André Uys:** *B.Sc., BChD. Dip.Odont. (Materials), Dip. Odont. (Endo), M.Sc. (Odont.), PhD,* Department of Oral Pathology and Oral Biology, Faculty of Health Sciences, University of Pretoria, Gauteng, South Africa.
4. **Paul Brandt:** *BChD (Stell), MSc (Odont), Adv Dip Aesthet Med (FPD),* Department of Restorative Dentistry, University of Pretoria, Pretoria, South Africa.
5. **Elmine Crafford:** *BChD, BChD Hons, Oral Medicine, MChD OMP,* Senior Specialist Department of Oral Medicine and Periodontics, University of Pretoria, Pretoria, South Africa.

Corresponding author: Leanne M Sykes
Head of Department of Prosthodontics, University of Pretoria, Pretoria, South Africa.
Email: leanne.sykes@up.ac.za

Author contributions:

1. **Leanne M Sykes:** First author - 40%
2. **Thomas C Postma:** Second author - 30%
3. **André Uys:** Third author - 10%
4. **Paul Brandt:** Fourth author - 10%
5. **Elmine Crafford:** Fifth author - 10%

INTRODUCTION

The strategic drive towards online learning,[1] requires Universities to develop the necessary competencies to empower students to reap a multitude of benefits.[2,3]

In line with this, many academic institutions have been encouraging lecturers to implement flipped-learning-methodologies. The aim being that students will carry out pre-class groundwork, come to the class prepared and ready to engage with the lecturer, and then consolidate their knowledge through after class revision.

Preparation involves accessing information posted electronically, including reading selected chapters from ebooks, or PDF notes, watching Power Point slide

shows, videos and links to YouTube presentations or visiting recommended internet study sites. During lecture time, students have opportunities to ask questions rather than sitting through a traditional formal lecture. Thereafter they will be given online revision exercises, assignments and assessments to complete in order to consolidate their new knowledge and provide the lecturers with a form of continuous evaluation. Many lecturers have been moving away from providing hand-out notes to their students and have opted for posting lecture material and tutorials online, in addition students have queried the need to purchase prescribed textbooks due to costs and dated content.

Since the increase in internet usage, it has become an important medium for communication as it is easy to access all kinds of information quickly and directly. It allows information to be used for entertainment, leisure, social, educational and research purposes.

Park (2009) suggested that its two greatest benefits are in communication and information exchange. Its most valuable utility lies in the ever-growing information stockpile with boundless communication potential that allows for interactive online learning and research, innovation, and enhanced scholarship across continents.[4]

Online learning can additionally be used as a tool to access the latest news on a global scale, allowing for rapid dissemination of information to a wide audience.[4] Not only does this have the potential to improve the quality of education, but it also allows students to augment their knowledge through self-study and critical appraisal of content. It also holds promise to enhance problem-solving, creative thinking and collaboration.[5,6] Despite obvious advantages, the uptake and usage has been slow and erratic amongst both staff and students.

The outbreak of the novel Coronavirus (C19) and the enforced country wide shut down, has meant that lectures and clinical sessions have had to be cancelled and there is no longer the opportunity for active engagement in the classroom. Such circumstances compelled educators to explore and expedite online possibilities of teaching, learning and assessment.[7]

The presumption is that all students possess the requisite technological skills and competencies, and are comfortable using and interacting on the various internet platforms. Unfortunately, this strategy requires an increased amount of self-regulated learning,[8,9] which may result in cognitive overload and a breakdown in the learning process[1] due to reduced support from a lecturer.[10]

It is indeed not easy for a novice to sift through a magnitude of information and to decide what is important.[10] This situation negatively influences self-efficacy belief, motivation,[11] and perceived self-competence,[13] and may result in decreased performance in this context.[13] Struggling with the technical aspects of technology on top of the requirements of the cognitive load that self-study requires, will further exacerbate the whole situation.[1]

Hence, this study aimed to gauge online learning requirements as well the self-perceptions of dental students about their digital competence in a learning environment. The hypothesis was that dental students do possess some form of digital competence, but their ability may be lacking when it comes to higher order self-study on digital platforms. The results of this needs assessment study could inform further action required to inform ongoing curriculum improvement.[14]

MATERIALS AND METHODS

Study outline and sample selection

A cross-sectional survey was administered in the latter half of 2017 to all dental students from the second to the fifth year of study at the Oral and Dental Hospital of the University of Pretoria. The estimated target was 240 students, evenly spread through the years of study (average 60 students per year).

Students were assured that all questionnaires would remain anonymous and all comments would be kept confidential. Students who had related concerns were encouraged to seek assistance from a lecturer or the researchers.

Questionnaire

A structured questionnaire was given to all students which included a brief demographic survey (sex, year of study and place of residence). The survey also enquired the frequency of use of the online resources in the context of their studies (refer to the leftmost column in **Table 1** for the detailed questions asked).

Students could either mark 0 = Never, 1 = Once or twice a semester, 2 = Monthly, 3 = Weekly, 4 = Daily. In addition, their self-perceived competence in using the internet (in different ways), for study purposes, was also gauged (refer to the leftmost column in **Table 2** for the detailed questions asked).

All questions were rated on a 5-point Likert scale:
0 = Strongly Disagree, 1 = Disagree, 2 = Neutral, 3 = Agree, 4 = Strongly Agree. Zero to three and four and five were collapsed together to form “Low” and “High” categories of perceived self-competence, respectively.

The statistical analysis was purely descriptive using frequency distributions.

RESULTS

A total of 218 dental students responded (87.2% response rate). Not all student answered all the questions, hence the percentages in the results below does not reflect the 218 (total) responses, only those who answered each question.

The demographic characteristics of the sample can be viewed in **Figure 1**. Respondents were evenly spread in terms of year of study ranging between 23.5 -27.6% from the second to the fifth year. Only 26.4% were male and the rest female.

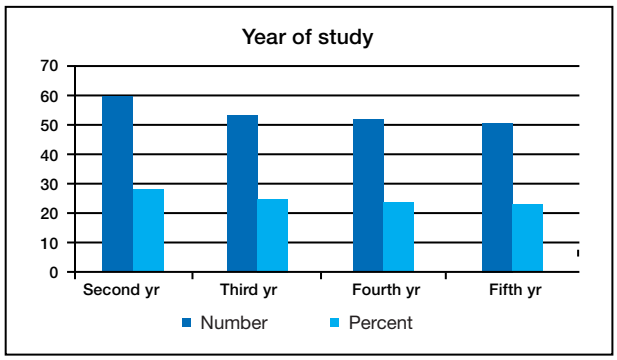


Figure 1. Year of study

Table 1 indicates the various academic requirements that involve accessing the internet for learning and assessment purposes, as well as the frequency of use.

Table 2 contains a summary of students' agreement about their competence in e-learning skills (in descending order).

Highest agreement was achieved for the general use of search engines, the downloading of pictures, learning from printed material, networking using messaging applications, and identification and downloading of relevant videos.

Reading scientific papers related to lecture material and the conducting of self-directed learning on recent information and the latest developments received the lowest confidence ratings. More than 60 students indicated a feeling of low self-competence in this regard.

DISCUSSION

This study aimed to gauge online learning requirements and perceived self-competence of dental students to utilise certain elements of the online learning space. This needs assessment was conducted to help inform curriculum transformation[14] in the context of online learning. High quality patient care is only possible if dentists have received high quality teaching in their undergraduate years.[15] Varied responses of online learning requirements (Table 1) are reflective of the collated results of the variable requirements for different years of study and different preferences among students. What is more important to note is that, at the time of this study, there was not a high daily, or even a weekly demand to engage with online resources, except for reading messages and announcements. There were also not too many true blended learning activities in the programme which, at that time, relied predominantly on teacher-centred lecture periods and limited online requirements.

Table 1. University requirements that involve the use of Information Technology.

Frequency of need to access the internet for:	Never 0	Once or twice/semester 1	Monthly 2	Weekly 3	Daily 4
Acquiring lecture materials, study guides and schedules.	0%	2.8%	3.2%	50.5%	42.7%
Completion of quizzes.	2.3%	22.5%	41.7%	23.9%	8.7%
Completion/submission of assignments that count for marks	0.5%	37.2%	34.4%	21.6%	6.0%
Checking marks on *clickUp*	1.8%	5.5%	29.4%	45.6%	17.0%
Reading announcements / general info on modules or from the university	0.9%	2.8%	6.9%	33.5%	55.5%
Use of the computers in the computer labs on campus	29.8%	32.5%	17.05%	12.4%	8.5%

Table 2. Student agreement on competence levels related to e-learning.

Question	Agreement				
		Low (0-2)		High (3 and 4)	
I feel competent to:		n	%	n	%
Use search engines like Google, Yahoo etc.	N	10	4.7%	205	95.3%
Download pictures or photos from the Internet for research and assignments.	N	17	7.9%	199	92.1%
Learn from lecture material provided to me in printed form.	N	17	7.9%	199	92.1%
Establish a connection with my friends on the Internet via MSN, Yahoo Messenger, Facebook, WhatsApp etc.	N	19	8.8%	197	91.2%
Identify, download or watch relevant videos related to my studies.	N	21	9.7%	196	90.3%
Do research on the Internet.	N	28	12.1%	204	87.9%
Learn from lecture material provided to me on electronic platforms.	N	34	15.7%	182	84.3%
Use an e-dictionary to look up terms I do not understand.	N	36	16.8%	178	83.2%
Learn more about topics that were explained in lectures, or seen clinically, and which and took my attention.	N	37	17.1%	179	82.9%
Share any kind of data with my friends on the Internet	N	42	19.4%	174	80.6%
Complete short quizzes and assignments on work I have to research myself	N	51	23.6%	165	76.4%
Conduct self-directed learning on recent information and the latest developments	N	63	29.2%	153	70.8%
Read scientific papers related to lecture material from different web sites	N	67	30.9%	150	69.1%

The results of this study show that the respondents had a lot of confidence that they were competent in performing basic digital literacy tasks such as online searches, downloading content, interacting socially, doing online research, dictionary lookups and exploring content in a broader way. This is not surprising as many of the students grew up with such technology and may have also received some training in this regard.

Self-confidence in online learning abilities, however, appeared to have dropped among a greater proportion of students when it came to completing quizzes that required self-study, conducting research on latest developments, and reading scientific papers from different resources.

These tasks require higher cognitive functioning and considerable self-control, focus and dedication. Tasks like these can easily cause students who lack self-regulation skills to lose their motivation, eventually give up and abandon learning because they doubt their abilities.[13]

It is surely significant if sixty, or so, dental students out of 218 do not have self-competency-belief to perform such tasks and will require some remediation. They maybe lacking in this regard because they are not regularly required to do online self-study.

The problem is clearly not seated in the technology itself but rather in the students' struggle to identify and prioritise important knowledge.[11] This can only be overcome through repeated practice in context with proper scaffolding and support structures to prevent consistent cogitative overload.[10]

To achieve this, authentic exercises requiring these skills will have to be rolled out as part of teaching, learning and assessment, for example, to continuously look for the latest evidence[16] to diagnose and to perform procedures.

This will require reading scientific literature and to evaluate new knowledge against existing knowledge. To achieve this, students will have to learn life-skills such as self-control, patience, focus and dedication to enhance their online learning skills.[17]

It will also require teachers to make a paradigm shift away from teacher-centeredness towards cultivating life-long learning.[18] It is presumed that students know where and how to look for information on the internet, and thereafter how to communicate and interact with their peers and supervisors as corroborated by the results of this study. Increased focus should therefore go into teaching students the use of library resources even from remote locations.

They need to acquire the ability to use online and offline databases as well as web search-engines effectively to reach the information they need, and to then critically appraise it and extract the necessary, relevant and accurate data amongst a sea of irrelevant communications. According to Nentwich (2003) the ability to find, organize, structure and evaluate information is critically important,[19] requiring three important internet literacies. Critical literacy, firstly, requires a deep, socially contextualized, and updated comprehension of the internet. Creative literacy, secondly, requires the aptitude to experiment online in order to recognise and construct information. Network literacy, thirdly, necessitates an ability to effectively and apply internet technologies to communicate and collaborate to construct and share knowledge in an ethical way.[20]

In striving for educational advancement, many lecturers at the School of Dentistry, University of Pretoria were starting to move away from handing out notes and manuals and were uploading lecture material and related references on on-line platforms such as *clickUP* for students to access before and after the lectures.

The aim was to have learners read through the material and prepare for each lecture beforehand, and to then use the lecture time to get clarity and additional information. Other advantages of an online approach are that notes can easily be modified with current information, augmented with explanations and illustrations of associated clinical procedures, materials and techniques, and reference sources added or updated as needed. They are also using various other virtual / internet sites such as email, and WhatsApp for posting assignments, giving feedback, and displaying grades.

Advantages are that they can communicate on a personal level or through group messages depending on the need for privacy and confidentiality. These can also be used to post revision exercises and quizzes and to monitor how learners are progressing with their studies. Lecturers can reach a wider audience on a more personal level, while learners have to ability to study at their own pace and to revisit topics that they find confusing or difficult to conceptualize.

The teacher's role is to impart knowledge using the most effective teaching strategies for each purpose. In addition, they should discuss learning goals, provide explanations, pose questions, provide sources for further reading, and if possible, have mechanisms that allow for interaction and evaluation.[15] Clinical teachers have an inherent obligation to maintain their own competence as teachers and to continually improve their tuition skills and methods to be in keeping with learner's requirements.[21]

The current COVID-19 disruption has drastically changed the need for self-study and online learning, which may have a lasting impact in higher education. The current study suggests that students were not necessarily well prepared for these increased demands. Students were sent home during lockdown periods and if this study was repeated today, the actual numbers would be worse because of sub-par access to information technology and living conditions of many of the learners. While the school cannot do much about the present situation, it may be necessary to implement measures, and structure both immediate and ongoing courses to ensure all students acquire the necessary skills and competencies to use the internet to its full potential. This will be crucial for the current year when there is going to be a huge demand for "catch up" learning.

Although this research was conducted prior to the pandemic, it provides valuable insights in how students were prepared for independent self-study using online platforms. The 2020 second year cohort, who was part of this study, is now in final year and there is no reason to believe that the traditional teaching and learning strategies employed in 2017 were much different from what happened until the start of 2020.

The forced isolation of staff and students has made the findings crucial for lecturers to ascertain whether the new initiatives will be of educational benefit, and to identify problems they may have with this.

CONCLUSION

Most students had high levels of confidence in the basic digital literacy used in everyday life, but need additional development in higher order skills such as self-study, conducting research on latest developments and reading and interpreting scientific papers from different resources.

These skills should be built into new curricula and be developed through repeated practice with proper scaffolding and learner support to increase self-efficacy belief and self-competence. Changing the attitudes of lecturing staff to adopt such strategies in an appropriate way will be crucial.

References

1. Panigrahi R, Srivastava PR, Sharma D. Online learning: Adoption, continuance, and learning outcome—A review of literature. International Journal of Information Management. 2018 Dec 1; 43: 1-4.
2. Tsai CW. Applying online competency-based learning and design-based learning to enhance the development of students' skills in using PowerPoint and Word, self-directed learning readiness, and experience of online learning. Universal Access in the Information Society. 2018 Nov 1; 1-2.
3. Ng'ambi D, Brown C, Bozalek V, Gachago D, Wood D. Technology enhanced teaching and learning in South African higher education–A rear-view of a 20 year journey. British Journal of Educational Technology. 2016 Sep; 47(5): 843-58.
4. Dogruera N, Eyyamb R, Menevis I. The use of the internet for educational purposes. Social and Behavioural Sciences. 2011; 28: 606-11.
5. Charp C. The millennium classroom. The Higher Education Journal. 2000; 27(10): 10-12.
6. Ciglaric M, Vidmar T. The use of Internet technologies for teaching purposes. European Journal of Engineering Education. 1998; 23(4): 497-503.
7. Huang RH, Liu DJ, Tlili A, Yang JF, Wang HH. Handbook on Facilitating Flexible Learning During Educational Disruption: The Chinese Experience in Maintaining Undisrupted Learning in COVID-19 Outbreak. Beijing: Smart Learning Institute of Beijing Normal University. 2020.
8. Barak M, Hussein-Farraj R, Dori YJ. On-campus or online: examining self-regulation and cognitive transfer skills in different learning settings. International Journal of Educational Technology in Higher Education. 2016 Dec; 13(1): 35.
9. Adam NL, Alzahri FB, Soh SC, Bakar NA, Kamal NA. Self-regulated learning and online learning: a systematic review. In International Visual Informatics Conference. 2017 Nov 28; 143-154.
10. Sweller J, van Merriënboer JJ, Paas F. Cognitive architecture and instructional design: 20 years later. Educational Psychology Review. 2019 Jan 22; 1-32.
11. Aharony N, Gazit T. Students' information literacy self-efficacy: An exploratory study. Journal of Librarianship and Information Science. 2020 Mar; 52(1): 224-36.
12. Burns RA, Crisp DA, Burns RB. Competence and affect dimensions of self-concept among higher education students: a factorial validation study of an academic subject-specific self-concept. European Journal of Psychology of Education. 2018 Oct 1; 33(4): 649-63.
13. Bradley RL, Browne BL, Kelley HM. Examining the influence of self-efficacy and self-regulation in online learning. College Student Journal. 2017 Dec 1; 51(4): 518-30.
14. McKenney S, Reeves TC. Conducting educational design research 2nd ed. Routledge. 2018.
15. Cornelia RM, Fluit D, Bolhuis S, Grol R, Laan R, Wensing M. Assessing the Quality of Clinical Teachers. A Systematic Review of Content and Quality of Questionnaires for Assessing Clinical Teachers. J Gen Intern Med. 2010; 25(12): 1337-45.
16. Lalla RV, Li EY, Huedo-Medina TB, MacNeil RL. Evaluation of an Experiential and Self-Learning Approach to Teaching Evidence-Based Decision Making to Dental Students. Journal of dental education. 2019 Oct 1; 83(10): 1125-33.
17. Gorbunovs A, Kapenieks A, Cakula S. Self-discipline as a key indicator to improve learning outcomes in e-learning environment. Procedia-Social and Behavioral Sciences. 2016 Oct 5; 231: 256-62.
18. Carlson ER. Lifelong Learning: A Higher Order of Consciousness and a Construct for Faculty Development. Journal of Oral and Maxillofacial Surgery. 2019 Oct 1; 77(10): 1967-e1.
19. Nentwich M. Cyberscience – Research in the age of the Internet. Austrian Academy of Science Press, editor. Vienna. 2003.
20. Burgess J. Blogging to learn, learning to blog. Use of Blogs. Bruns A, Jacobs J, editor. New York: Peter Lang; 2006.
21. Snell L, Tallett S, Haist S, Hays R et al. A review of the evaluation of clinical teaching: New perspectives and challenges. Med Educ. 2000 Oct; 34(10): 862-70.

No.1 DENTIST RECOMMENDED BRAND FOR SENSITIVE T

*GFK New expert performance tracking 2018.

For any product safety issues, please contact GSK on +27 11 745 6001 or 0800 118 27

With clinically proven Dual relief

TEETH*

4.

http://dx.doi.org/10.17159/2519-0105/2020/v75no7a6

Dental enamel

SADJ August 2020, Vol. 75 No. 7 p384 - p386

GH Sperber

ABSTRACT

Dental enamel is the sparsest but most enduring component of all the tissues in the human body, yet contrarily contains the most detailed historiography of its development.

Accordingly, analysis of enamels' chemistry, histology and pathology can reveal detailed ambient information of both fossilized, long-deceased and its contemporary milieu occurring during amelogenesis. In this respect, dental enamel is the most versatile exponent of its developmental mechanisms and acquisition of its complex form. Dental enamel is the ultimate lexicographer of lives lived.

INTRODUCTION

Dental enamel constitutes the least quantitative and rarest component of all tissues in the human body but is the most enduring and hardest constituent of ectodermal cellular development. Dental enamel is composed primarily of apatite and has a hardness between steel and titanium of 5 on the Mohs' hardness scale.

Dental enamel can be a harbinger of history, reflecting the environment during the time it was being formed. Enamel first appeared around 415 million years ago when the suite of genes that encode the proteins required to make enamel appeared in the scales of sarcopterygians.[1]

The evolution of prismatic enamel was an innovation that made teeth more resilient to abrasion and allowed for the expansion of the dietary herbivorous range. Moreover, it diminished the necessity of constant tooth replacement that characterizes reptilians. Thus, the first appearance of prismatic enamel in Late Cretaceous sphenodontians marked an evolutionary advance in odontological development.[2]

The vitreous nature of enamel provides its white lucent, iridescent and gleaming appearance as a physically attractive feature of a human smile, but contrarily, it may provide a snarling repulsive warning of a sneer. The production of enamel by ameloblasts is among the most complex tissues of histogenesis. Amelogenesis is so specialized in its production of enamel that it is not replaceable as enamel in any form of tissue repair.

Author affiliations:
Geoffrey H Sperber: *BSc(Hon), BDS, MSc, PhD, Dr Med Dent, FICD, FRSSAf.,* School of Dentistry, Faculty of Medicine & Dentistry, University of Alberta, Edmonton, Alberta, Canada.
ORCID Number: 0000-0002-2590-6197
Email: gsperber@ualberta.ca

Accordingly, any damage to enamel, be it by acidogenic decay or trauma has become the raison d'etre for the dental profession in repairing the consequences of enamel loss. Enamel is an instantaneous fossilized tissue developing *in situ* during amelogenesis in living individuals that consequently reflects the environmental and metabolic status of an individual.

Any deviation of the genetically determined pathway of enamel formation is permanently imprinted upon the histology of enamel, providing enduring evidence of its dysmorphogenesis. Hence, the genetically determined condition of amelogenesis imperfecta is engrafted upon enamel during its formation and is revealed post-eruption on the teeth exhibiting hypoplasia.

Moreover, enamel is unique in both providing information on extant living individuals, and on long-deceased and extinct fossilized species. The elemental signatures retained in enamel can reveal seasonal dietary stresses in both extant and extinct species.[3]

ENAMEL FORMATION

Enamel contains an exquisitely intricate and ordered arrangement of mineral crystals packed so densely that it is harder than iron. Amelogenesis is an enormously complex process involving numerous interactions. The elaboration of enamel as a complex combination of enamelin and tuftelin and amelotin secreted by ameloblasts that take a path from the delicate scalloped amelodentinal junction to the destined cusp tip and down into the crevices of the fissures and along the ultimate enamel margins.

The variation of the thickness of enamel at these different locations must presumably be genetically determined by ameloblast viability, diminishing from the peaks of the tooth cusps to the ultimate cessation of amelogenesis at the enamel margins. It would be interesting to investigate the longevity of marginal ameloblasts if they could be transferred to cusp tip locations. Is their fate determined by genes or by location?

During amelogenesis, the physical or epigenetic interactions between the inner and outer layers of the enamel organ might determine enamel thickness. Six genes are implicated in amelogenesis: enamelin ENAM; ameloblastin AMBN; amelotin (AMTN); AMELX/AMELY amelogenin gene on XY chromosomes; MMP20 matrix metalloproteinase; KLK4 kallikrinen 4 gene.[4] Variable stages of enamel secretion produce cross striations along enamel prisms.

Variation in this daily growth determines the development of the thickness of the enamel. The ameloblastin and amelogenin matrix proteins formed during early stages

of amelogenesis are removed during maturation by degradation. The accumulated degraded matrix proteins inhibit further ameloblast activity, thereby determining the thickness of deposited enamel.

Such interactions may modulate different ameloblast location longevity, and hence, enamel thickness. Ameloblasts located at a molars' highest cusps can produce enamel as thick as 6 mm. Variations in enamel thickness in the deciduous dentitions of hominoids (H. sapiens, Pan troglodytes, Gorilla and Pongo) have recently been explored.[5]

The thickness of dental enamel may act as a proxy for the durability of a tooth and reflect dietary preferences and possibly the lifespan. The varying patterns of wear and of enamel thickness correlates with dietary preferences and can act as a proxy for different diets.[6]

Enamel thickness has been studied in Plio-Pleistocene hominin mandibular molars, wherein the thick enamel of the robust Australopithecus species decreases in early Homo to that of modern humans.[7] Ancient protein analysis of an Homo antecessor molar, dated to 772-949 thousand years ago using electron spin analysis and U-series dating has revealed the dental proteome of this species.[8]

The enamel thickness of Gigantopithecus blacki, over 6 mm in places, was adapted to heavy wear in a way that differed from Pliocene and Pleistocene hominids.[9] G. blacki was adapted to consuming tough fibrous food, and its thick molar enamel allowed for relative longevity.[10]

Dental enamel is the hardest tissue in the body that is initiated in a protein gel that is impregnated by nanometer size minerals in a three-dimensional network. The remarkable strength of enamel comes from its ingenious structure that gives it the hardness and toughness to resist the start and spread of cracks.

The newly formed enamel matrix is an amorphous calcium phosphate that transforms into apatite crystals. Apatite crystals in human enamel deviate from one another by 1-30 degrees in orientation conferring toughness.[11] Misorientation of adjacent enamel crystals induce crack deflections that confers the unique resilience of enamel.[12] The enamel rods or prisms run parallel to one another from the tooth surface to the underlying dentin, but weave and twist as they go by in an elegant configuration that confers the significant durability of enamel.

The complex structure of enamel is revealed by microscopic examination.[13] Enamel has a highly hierarchical structure with complexities arising from chemical gradients. The crystals of enamel are composed of Apatite (Ca5 (PO4) 3 (F, Cl, OH) that is constituted of hydroxyapatite, fluorapatite and chlorapatite.

Nanoscale crystallites of hydroxyapatite are comprised of two flanking nanometric layers enriched with magnesium surrounding a core of sodium, fluoride and carbonate ions. Varying gradients of these chemical ions create stresses that affect the mechanical and solubility resilience of enamel to acid attacks.[14]

Fluorapatite is the least susceptible component to acid disintegration, making it the reason for fluoridation of drinking water to reduce dental decay. The opportunity to regenerate dental enamel is being explored.[15] The composition of dental enamel impacts its varying reactions to its pathological disintegration.[16]

Spectroscopic analysis of enamel formed during a period of high radioactivity of ^{14}C isotopes in the atmosphere, as at the time of the Chernobyl explosion, can identify the date of enamel formation. Similarly, the ^{18}O isotope content of dental enamel provides evidence of the quality of ingested vegetation during wet or dry periods occurring during amelogenesis.

Enamel isotopic evidence provides information of early hominid diets.[17] Analyses of linear enamel hypoplasia indicate aspects of enamel development and morphology.[18] Further, the administration of tetracycline antibiotics during enamel formation is permanently imprinted on teeth, revealed after their eruption.[19,20]

CONCLUSION

Despite being the least quantitative tissue in the human body, the composition of dental enamel comprises the most comprehensive registry of its formation permanently imprinted in the most enduring constitutional component of any anatomical structure.

The incredibly complex combination of diverse chemical elements incorporated in the constitution of dental enamel provides enduring fascination of the vivid tissue emplaced in our mouths. The historiography of an individual is embedded in the composition of the tooth. Dental enamel is the ultimate lexicographer of a life lived.

References

1. Ungar P. The Trouble with Teeth. Scientific American. 2020; 322(4); 44-9.
2. LeBlanc ARH, Apesteguia S. et al. Unique tooth morphology and prismatic enamel in Late Cretaceous Sphenodontians from Argentna. Current Biol. 2020; 30: 1755-61.
3. Johannes-Boyau R, et al. Elemental signatures of Australopithecus africanus reveals seasonal dietary stress. Nature 2019; 527: 112-5.
4. Bartlett JD, Simmer JP. New Perspectives on Amelotin and Amelogenesis. J Dent Res. 2015; 94(5): 642-5.
5. Ortiz A, Schander-Triplett K, et al. Enamel thickness variation in the deciduous dentition of extant large-bodied hominoids. Am J Phys Anthrop. 2020; doi: 10.1002/ajpa.24106.
6. Le Luyer M, Rottier S, Bayle P. Comparative patterns of enamel thickness topography and oblique molar wear in two early Neolithic and Medieval population samples. Am J Phys Anthrop. 2014; 155: 162-72.
7. Skinner MM, et al. Enamel thickness trends in Plio-Pleistocene hominin mandibular molars. J Hum Evol. 2015; 85: 35-45.
8. Welker F, et al. The dental proteome of Homo antecessor. Nature. 2020; Doi.org./19.1038/s 41586-020-2153-8.
9. Kono RT, et al. A 3-dimensional assessment of molar enamel thickness and distribution pattern in Gigantopithecus blacki. Quarterly International. 2014; 354: 46-51.
10. Wang WJ. New discoveries of Gigantopithecus blacki teeth from Chuifeng Cave in Bubing Basin, Guangxi, South China. J Hum Evol. 2009; 57: 229-40.

11. Pupa U et al. The Hardest Tissue. American Scientist 2020; 108: 14-5.
12. Beniash E, Stiffler CA, et al. The hidden structure of human enamel. Nature Communic. 2019; 10: 4383.
13. Kelly AM et al. Measuring the Microscopic Structure of Human Dental Enamel. J Pers Med. 2020; 10 (5): 1-17.
14. DeRocher, KA, Smeets PJM, Goodge PH et al. Chemical gradients in human enamel crystallites. Nature. 2020. 583: 66-71.
15. Elsharkaway S, Al-Jawad M. et al. Protein disorder-order interplay to guide the growth of hierarchical mineralized structures. Nature Communic. 2018; 9(1): doi: 10.1038/s1467-018-04319-0.
16. Lacruz RS, Habelitz S, Wright T, Paine ML. Dental enamel formation and implications for health and disease. Physiol Rev. 2017; 97: 939-93.
17. Sponheimer M, Lee-Thorp JA. Isotopic evidence for the diet of an early hominid Australopithecus africanus. Science. 1999; 283: 368-70.
18. Guatelli-Steinberg D. Macroscopic and microscopic analyses of linear enamel hypoplasia in Plio-Pleistocene South African hominins with respect to aspects of enamel development and morphology. Am J Phys Anthrop. 2003; 120: 309-22.
19. Vennila V, Madhu V, et al. Tetracycline-induced discoloration of deciduous teeth: Case series. J Internat. Oral Health. 2014; 6(3): 115-9.
20. Sanchez AR, Rogers III MD, Sheridan PJ. Tetracycline and other tetracycline-derivative staining of the teeth and oral cavity. Int J Dermatol. 2004; 43(10): 709-15.

Do the CPD questionnaire on page 400

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.

Online CPD in 6 Easy Steps

1 Go to the SADA website www.sada.co.za.
2 Log into the 'member only' section with your unique SADA username and password.
3 Select the CPD navigation tab.
4 Select the questionnaire that you wish to complete.
5 Enter your multiple choice answers. Please note that you have two attempts to obtain at least 70%.
6 View and print your CPD certificate.

http://dx.doi.org/10.17159/2519-0105/2020/v75no7a7

A giant submandibular sialolith - How to manage?

SADJ August 2020, Vol. 75 No. 7 p387 - p390

J Anand[1], A Suresh[2], AK Desai[3]

ABSTRACT

The presence of a sialolith is one of the most common diseases of salivary gland. It is relatively common in submandibular salivary glands and its duct.

This case report is of a patient who presented at our unit with a history of severe pain and swelling on floor of the mouth, which was clinically and radiographically diagnosed as a sialolith. The diagnostic and treatment protocol in managing a patient with a giant sialolith is enumerated in this manuscript.

INTRODUCTION

One of the most common diseases that affect the salivary glands and a major cause of salivary gland dysfunction is salivary stone.[1]

Studies have reported that the overall incidence is 1% in the population.[2] Most of the cases remain asymptomatic.

The incidence of occurrence in sub-mandibular region is relatively high, 80-90% as compared to parotid region, 5-20% and the sub-lingual and other minor salivary glands which range from 0-10%.[3,4,5]

When minor salivary glands are involved mainly in the buccal mucosa, of the upper lip which forms a firm nodule which may mimic a tumour. The largest salivary gland stones are formed by sub-mandibular glands. Salivary stones are single in 70-80% of the cases and are also presented as multiple, usually two or three in number rarely.

Author affiliations:
1. **Jawahar Anand:** *MDS,* Assistant Professor, Department of Oral and Maxillofacial Surgery, SDM College of Dental Sciences, Shri Dharmasthala Manjunatheshwara University, Dharwad.
   ORCID Number: 0000-0001-6730-9609
2. **Amal Suresh:** *MDS,* Resident, Department of Oral and Maxillofacial Surgery, SDM College of Dental Sciences, Shri Dharmasthala Manjunatheshwara University, Dharwad
   ORCID Number: 0000-0002-9239-9930
3. **Anil K Desai:** *MDS, Professor and Head of Department,* Dept. Of Oral and maxillofacial surgery, SDM Craniofacial Surgery and Research Centre, SDM College of Dental Sciences and Hospital, Dharwad, Karnataka, India.

Corresponding author: Jawahar Anand
Asst Professor, Dept of Oral and Maxillofacial Surgery, SDM Craniofacial Surgery and Research Centre, SDM College of Dental Sciences, Dharwad.
Email: jawanand@gmail.com

Author contributions:
1. **Jawahar Anand:** Principal Researcher - 33.3%
2. **Amal Suresh:** Writing the manuscript - 33.3%
3. **Anil K Desai:** Mentor - 33.3%

Nearly 88% of sialoliths are reported to be of a size less than <10mm in dimensions. According to literature the development of an atypically large, >15mm sialolith was found to be sporadic.[6]

Most common manifestations of salivary lithiasis include pain and swelling, especially during pre-meal period wherein the salivary flow is stimulated. The sialolith obstructs the normal salivary flow which can lead to multiple disabilities in the oral cavities.

Reports of huge salivary calculi have been reported in the literature. This manuscript is a case report of a Submandibular sialolith and describes the clinical presentation, examination, investigations, and the surgical excision.

CASE REPORT

A 69 years old male patient reported to our unit with chief complaint of pain in left side of floor of mouth for the past 15 days. He presented with pain associated with a diffuse swelling on the left side in the floor of mouth.

The pain was sudden in onset, with severity in intensity and continuous in nature. The pain was aggravated with eating. The associated swelling was initially minor and gradually increased to the present size over time.

On examination a solitary diffused swelling was noted in left side of floor of mouth with a sinus opening in relation to the 36, 37 region (**Figure 1A**). Also, an extra-oral swelling was noted in the sub-mandibular region measuring about 2cm in diameter. Swelling was oval in shape, firm, tender and not attached to underlying structures. The left submandibular lymph node was palpable and was tender.

A mandibular occlusal radiograph was advised, which revealed a homogenous radio-opaque structure in left submandibular region in relation to the 36, 37 area, which was oval in shape with well-defined borders and measuring approximately 1x1 cm (**Figure 2A**).

Also, a CBCT was advised to determine the position of the sialolith (**Figure 2 B, C, D**). Based on the clinical and radiographic presentation we came to a diagnosis of a Surgical excision of the sialolith under local anaesthesia was suggested as the treatment plan.

Routine minor surgery protocol was followed and 2% lignocaine with adrenaline 1:80,000 was infiltrated around

the pathology. An incision was placed of around 1cm over the most prominent part of the pathology. Blunt dissection was carried out through the Wharthon's and the sialolith was identified to expose it completely (**Figure 1B**). The sialolith was removed in toto which measured 2.2x1.9 centimetres and weighed 3.33 grams (**Figure 1C and 3**).

The duct was examined using Adson's forceps and mucous secretions were seen. The duct irrigation was done using betadine and saline. Milking of gland was performed to confirm the normal function of salivary gland. 5 simple interrupted 3-0 Black Braided Silk sutures were placed.

Postoperative instructions were given, to the patient and antibiotics and analgesics were prescribed for 5 days. The wound healed uneventfully without any complications. No recurrence was seen until the present date.

Figure 1.
a. Swelling on left floor of mouth.
b. Exposure.
c. Retrieval of sialolith from duct.

DISCUSSION

Exact cause of salivary gland calculi formation is unclear, but it is generally due to stagnation of calcium rich saliva.[7] Partial obstruction of flow from the gland is more important than complete obstruction from the patient's point of view because even though complete obstruction causes stagnation of saliva, it does not cause increase in stone formation.

In completely obstruction, there is depletion of the calcium secretory granules present in the acini and this saliva is less lithogenic.[8] Another theory says that for stone formation, it is likely that intermittent stasis produces a change in mucoid element of saliva, which forms a gel. This formed gel provides the framework for deposition of organic substances and salts which leads to formation of a stone.[9]

It also has been postulated that an unknown metabolic phenomenon can increase the salivary bicarbonate content, which alters calcium phosphate solubility and leads to precipitation of calcium and phosphorus ions.[10]

Irregular laminated morphology of the calculi gives an impression that it is formed intermittently. Light and electron microscopical studies have not found out any bacterial organisms or foreign bodies as the nidus for calculi formation.[11]

The composition is predominantly calcium phosphate and carbonate in the form of hydroxyapatite with small amounts of magnesium, potassium and ammonium, which is evenly distributed throughout the calculi.[12] The organic matrix is composed of various carbohydrates and amino acids.

Figure 2.
a. Mandibular occlusal radiograph showing well defined oval radio-opaque structure in relation to 37-38 region.
b. CBCT axial section showing relation of sialolith to mandible.
c. 3D Reconstruction image.
d. Transverse section showing the position of sialolith.

Figure 3. Sialolith after excision.

Submandibular gland stones are denser and calcium rich, related to the nature of secretions of the gland which is more mucinous compared to other glands.

The presence of a sphincter in the first 3 cm of the duct could result in the retrograde migration of these organic and inorganic ingredients and can lead to the formation of sialoliths, as suggested by Marchal et al.[13]

The factors favouring the formation of submandibular stone formation are longer and larger calibre ducts with slower salivary flow rates, salivary flow against gravity, alkalinity of the saliva secreted, and the high calcium and mucin content as mentioned earlier.[12,14] Demographically it shows a male predilection.[15] All ages may be affected but third to sixth decade has shown preponderance. Occurrence in the paediatric age group is rare. [3]

Long term obstruction without any active infection can lead to gland atrophy and ultimately leads to fibrosis and loss of secretory function. Inflammation, scarring of the duct and stricture formation are the common sequelae of intraductal stones. Strictures and stenosis lead to recurrent salivary outflow problems.

Patients presents with painful swelling in about 59% of cases whereas 29% reported to have painless swelling. They will be afflicted with a recurrent salivary colic and spasmodic pains upon having food. They may also experience repeated infections or abscess formation. Salivary stones can also be discovered as an accidental finding on routine dental evaluation.

Careful history and examination are the key in the diagnosis of this disorder. Having the patient close the mouth slightly will aid in detection of these stones by bimanual palpation. Even the palpation of gland can be informative.

If it is found to be spongy and elastic, it suggests a healthy gland and a uniformly firm gland may be suggestive of atrophied and hypo or non-functional gland. Plain radiography would be an excellent choice of investigation in which it be radio opaque in 80-95% of cases. Emergence of Cone Beam Computed Tomography is an easy, accurate, fast and relatively safe diagnostic tool in determining the position of the stones which can assist surgeon in planning the surgical approach. Ultrasonography is another investigation of choice to identify and locate sialoliths. It can even detect sialoliths of size 1.5 mm and has shown an accuracy of 99%.[16]

Submandibular sialoliths can be approached either through a transoral sialolithotomy approach or complete sialadenectomy through an extraoral approach.[17] The approach basically depends on the location of stone. Sialoliths that can be palpated bimanually and localized by ultrasound within the perihilar region of the gland should be approached by transoral approach.[18]

The position of the submandibular gland below the mylohyoid muscle in relation to the duct which is in the floor of the mouth also favours a transoral approach to the duct rather than an extra oral approach. The risk of damage to glandular and para-glandular tissues is avoided by an intra oral approach. Gland excision should be considered in the presence of symptomatic or recurrent sialadenitis which is caused by multiple intraparenchymal stones or due to the presence of a very large stone or when minimally invasive techniques fail.

Newer techniques like sialendoscopy and laser lithotriposy are also used but these techniques have its own limitations in removing a giant sialolith. A sialolith of 4-5 mm can be easily removed using endoscopic technique by an experienced surgeon.[19]

A giant sialolith, as presented in our case report is difficult to be removed using these minimally invasive techniques, a 20% failure rate is reported by Marchal F even carried out by an experienced surgeon.[20]

Hence considering bigger size and clinically palpable sialolith without any glandular pathology we selected transoral approach for the sialolithotomy. 90% of the total saliva is produced by the parotid, submandibular and sublingual salivary glands with 10% from minor salivary glands. The submandibular salivary gland is the largest single contributor to baseline salivary flow. After removal of the gland or duct, the patient will have severe drop-in salivary flow rates.

Glands which are severely compromised will return to normal function in 75% of cases after sialolith removal by transoral approach. Evidences exist for significant acini regeneration after duct obstruction removal. Recurrence rates in patients who have undergone transoral sialolithotomy is 18%.

Lingual nerve paraesthesia is one of the common complications of the intra-oral approach. Both the lingual nerve and Wharton's duct pass deep to the mylohyoid muscle, and in the last part of the resection lingual nerve is present distal to the wharton's duct. The nerve can be identified easily and should be gently mobilised away from the surgical field preventing injury to nerve itself.

Our patient did not experience lingual nerve paraesthesia postoperatively. An external approach carries a risk of marginal mandibular nerve injury in 0-8% of cases.[21]

Also, there are reported cases of a ranula developing which is formed due disruption of salivary duct. Another possible complication is sialo-cutaneous fistula due to obstruction of the ducts resulting is salivary stasis, infection and rupture through the external skin.[22]

The usual size of a sialolith found in Whathon's duct ranges from 1-10 mm, in addition also there are reports of giant sialoliths greater than 3.2 cm. Ledenma-Montes et al. found 16 cases of sialolith of size greater than 3.5 mm in their review of the literature.[23] The largest size sialolith reported in the submandibular gland is 7.2 cm in length and in our case, it measured 2.2x1.9 cm.[24,25]

The mainstay of management of giant submandibular sialolith remains transoral sialolithotomy. Newer advancement is in diagnosis and localization of the calculi has helped the surgeon in planning the surgery so that the function of the salivary gland is restored with minimal or nil complications.

Funding

Nil funding received.

Competing interests

Nil conflict of interest.

Ethical approval

The manuscript was cleared by Institutional review board for this publication.

Patient consent

Consent taken from the patient.

References

1. ALMASRI, Mazen A. Management of Giant Intraglandular Submandibular Sialolith With Neck Fistula. Annals of Dentistry University of Malaya, [S.l.]. Dec 2005; 12(1): 41-5.
2. Rauch S, Gorlin RJ: Diseases of the salivary glands. In Gorlin RJ, Goldman HM (eds): Thomas' Oral Pathology, d 6. St. Louis, CV Mosby. 1970; 997-1003.
3. Bodner L, Fliss DM. Parotid and submandibular calculi in children. International journal of pediatric otorhinolaryngology. 1995 Jan 1; 31(1): 35-42.
4. Levy DM, ReMine WH, Devine KD. Salivary gland calculi: pain, swelling associated with eating. Jama. 1962 Sep 29; 181(13): 1115-9.
5. Mckenna JP, Bostock DJ, Mcmenamin PG Sialolithiasis. Am Fam Physician. 1987; 36119-125.
6. Lustmann J, Regev E, Melamed Y. Sialolithiasis: a survey on 245 patients and a review of the literature. International journal of oral and maxillofacial surgery. 1990 Jun 1; 19(3): 135-8.
7. Furstenberg A: Diseases of the salivary glands. JAMA 13614, 1948.
8. Harrison JD, Epivatianos A, Bhatia SN. Role of microliths in the aetiology of chronic submandibular sialadenitis: a clinicopathological investigation of 154 cases. Histopathology. 1997 Sep; 31(3): 237-51.
9. Harrill JA, King Jr JS, Boyce WH. Structure and composition of salivary calculi. The Laryngoscope. 1959 May; 69(5): 481-92.
10. BLATT I. Studies in sialolithiasis: III. Pathogenesis, diagnosis and treatment. Southern medical journal. 1964 Jun 1; 57(6): 723-9.
11. Brady JM, McKinney L, Stanback JS. Scanning electron microscopy of submandibular sialoliths: a preliminary report. Dentomaxillofacial Radiology. 1989 Feb; 18(1): 42-4.
12. Hiraide F, Nomura Y. The fine surface structure and composition of salivary calculi. The Laryngoscope. 1980 Jan; 90(1): 152-8.
13. Marchal F, Kurt AM, Dulguerov P, Lehmann W. Retrograde theory in sialolithiasis formation. Arch Otolaryngol Head Neck. 2001; Surg 127, 66-8.
14. Raksin SZ, Gould SM, Williams AC. Submandibular duct sialolith of unusual size and shape. J Oral Surg. 1975; 33: 142-5.
15. Auclair PL, Ellis GL, Gnepp DR, Wenig BM, Janney CG. Surgical pathology of the salivary glands. Salivary glands neoplasms: general considerations. WB Saunders, Philadelphia. 1991; 135-64.
16. Yoshimura Y, Inoue Y, Odagawa T. Sonographic examination of sialolithiasis. Journal of oral and maxillofacial surgery. 1989 Sep 1; 47(9): 907-12.
17. Williams MF. Sialolithiasis. Otolaryngologic Clinics of North America. 1999 Oct 1; 32(5): 819-34.
18. Zenk J, Constantinidis J, Al-Kadah B, Iro H. Transoral removal of submandibular stones. Arch Otolaryngol Head Neck Surg 2001; 127: 432-6
19. Pachisia S, Mandal G, Sahu S, Ghosh S. Submandibular sialolithiasis: A series of three case reports with review of literature. Clinics and practice. 2019 Jan 29; 9(1).
20. Marchal F. A combined endoscopic and external approach for extraction of large stones with preservation of parotid and submandibular glands. Laryngoscope 2007; 117: 373-7.
21. Ellies M, Laskawi R, Arglebe C, Schott A. Surgical management of nonneoplastic diseases of the submandibular gland: A follow-up study. International journal of oral and maxillofacial surgery. 1996 Aug 1; 25(4): 285-9.
22. Saluja H, Kasat VO, Mahindra U. Giant Sialolith in the Wharton's duct causing sialo-oral fistula: A case report and review of literature. Journal of Orofacial Sciences. 2012 Jul 1; 4(2): 137.
23. Ledesma-Montes C, Garcés-Ortíz M, Salcido-García JF, Hernández-Flores F, Hernández-Guerrero JC. Giant sialolith: case report and review of the literature. Journal of oral and maxillofacial surgery. 2007 Jan 1; 65(1): 128-30.
24. Vittal U, Shetty SC, Manvikar P, Kini U, Gupta S. Giant Sialolith (megalith) of submandibular salivary gland. Australian Journal of Oto-Laryngology. 2002 Apr 1; 5(1): 43.
25. Rai M, Burman R. Giant submandibular sialolith of remarkable size in the comma area of wharton's duct: A case report. J Oral Maxillofac Surg. 2009; 67: 1329-32

http://dx.doi.org/10.17159/2519-0105/2019/v75no7a8

What's new for the clinician?
- Excerpts from and summaries of recently published papers

SADJ August 2020, Vol. 75 No. 7 p391 - p394

Compiled and edited by V Yengopal

1. Is there an association between stress and periodontitis?

JM Coelho, SS Miranda, SS da Cruz, et al. Is there association between stress and periodontitis? Clinical Oral Investigations. 2020; 24: 2285-94.

INTRODUCTION

The psycho-physiological response of the organism to perceived challenge or threat is referred to as stress.[1] Stress is compatible with good health, being necessary to cope with the challenges of everyday life. Problems start when the stress response is inappropriate to the intensity of the challenge and it has been reported that periodontal disease is more widespread and severe in those with higher levels of stress.[1]

Psychological disturbances can lead patients to neglect oral hygiene with resultant unfavorable effects on the periodontal tissues. Although previous studies have suggested that stress may favour the occurrence of periodontitis, the evidence is still fragile, due to variations in the method and lack of standardization in the definition of exposure and outcome factors, and as a result of a small sample size.[1]

Coelho and colleagues (2020)[1] from Brazil reported on a cross-sectional study that sought to investigate the strength of the association between stress and periodontitis.

MATERIALS AND METHODS

Patient attending for care at dental clinics in Brazil was invited to participate in this cross-sectional comparative study consisting of two groups: the exposed group (individuals with exposure to stress) and non-exposed group. The target sample size was 235 per group with 470 in total.

Participants were included if they had at least four teeth to ensure the validity of periodontal status measurements, were not pregnant, or did not have cancer or HIV-AIDS, were not using anti-inflammatory medication in the 2 months prior to the study, and had no periodontal treatment in the 6 months prior to the survey.

Those with anterior infarction, percutaneous coronary revascularization history within the previous 6 months or surgical revascularization in the 2 months prior to the study were excluded.

Information related to socioeconomic and demographic characteristics, general and oral health condition, habits and lifestyle, medical and dental history, and access to oral health care was obtained through an interview questionnaire. Furthermore, each participant completed a Perceived Stress Scale survey.

Individuals underwent a complete periodontal examination by a single examiner, who had been previously trained. The degree of agreement of the collected clinical periodontal data, through the Kappa coefficient (0.87 with difference of ± 1 mm), showed good agreement.

The following clinical periodontal parameters were evaluated: probing depth, gingival recession, clinical attachment level, bleeding on probing, visible plaque index, and number of teeth.

These were obtained at six sites per tooth except the third molars, corresponding to the mesial buccal, medium-buccal, disto buccal, mesial lingual, mid-lingual, and disto lingual regions, through the use of a Williams periodontal probe. The visible plaque index was evaluated in four regions per tooth (mesial, distal, buccal, palatal/lingual).

The probing depth record was obtained by measuring the gingival margin at the deepest region of penetration of the probe. The measurement of gingival recession was the distance between the cementum-enamel junction and the gingival margin.

Veerasamy Yengopal: *BChD, BScHons, MChD, PhD*, Community Dentistry Department, School of Oral Health Sciences, University of Witwatersrand, Medical School, no. 7 York Road, Parktown 2193, South Africa.
ORCID Number: 0000-0003-4284-3367
Email: veerasamy.yengopal@wits.ac.za

The clinical attachment level was obtained by adding together the probing depth values and the gingival recession measurements of each site. The bleeding index was established by observing its occurrence up to 10s after the examination of probing depth.

The visible plaque index was evaluated using the probe only to confirm the presence of biofilm on the tooth surface. The data on lipid and glycaemic profile, body mass index (BMI), and blood pressure were later obtained from the medical records of study participants. These data and tests were performed within 30 days of the oral exam.

The participant was considered diagnosed with periodontitis when 4 or more teeth were present, with 1 or more sites with probing depth greater than or equal to 4 mm, with clinical attachment level greater than or equal to 3 mm in the same place, and the presence of bleeding on probing. Furthermore, two clinical parameters were also employed as surrogates for defining the presence of periodontitis: probing depth ≥ 4 mm and clinical attachment level ≥ 5 mm.

Stress was evaluated using the Perceived Stress Scale. This instrument has 14 questions with response options ranging from zero to four (0 = never, 1 = almost never, 2 = sometimes, 3 = often, 4 = always).

The questions with positive connotation (4, 5, 6, 7, 9, 10, and 13) had a punctuation as follows: 0 = 4, 1 = 3, 2 = 2, 3 = 1, and 4 = 0. The remaining questions are negative and were added directly.

Results varied from zero to 56. Finally, an arithmetic average was obtained to observe which individuals had stress greater than the average scores, thus defining the diagnosis of stress. As such, two groups were formed: (1) individuals with perceived stress score ≤ 24 - not exposed to stress group; (2) individuals with perceived stress score > 24 - the group exposed to stress.

RESULTS

The study included 621 individuals, of which 300 were female and 321 male, with a mean age of 59.42 ± 10.91 (± SD) years, median of 59 years and a range of 40-91 years in the group exposed to stress (301 individuals).

In the unexposed group (320 individuals without stress), the mean age was 59.40 ± 10 years (± SD), median of 58.5 years and a range of 40-89 years.

Data for sample characterization, socioeconomic and demographic covariables related to lifestyle habits, oral health, and overall health conditions proved to be homogeneous for most characteristics with statistically significant difference only for the covariables: gender ($P < 0.01$) and schooling level ($P < 0.01$).

The results showed that participants with stress, compared to those not exposed to this condition, were more frequently female (55.15% vs. 41.88%), and those with 4 years or less of study (82.67% vs. 72.84%).

The study individuals were reclassified according to the diagnosis of periodontitis and those with periodontitis (142 individuals) presented a mean age of 58.82 ± 10.90 (± SD), median of 56.5 years and a range of 40-84 years. And, for the group without periodontitis (479 individuals), they presented a mean of 59.67 ± 10.89, median of 59 years and a range of 40-91 years.

The distribution of the investigated covariables showed that the groups were comparable, with only current smoking habit showing a statistical difference between comparison groups, with higher occurrence of individuals with that habit in the group with periodontitis (19.01% vs. 12.32%).

The periodontal condition with greater alteration was observed in the group exposed to stress, with statistically significant differences in the number of teeth ($P = 0.02$), number of sites with clinical attachment level of 3 to 4 mm ($P < 0.01$), number of sites with clinical attachment level of 5 mm ($P = 0.04$), number of sites with a probing depth of 4 and 5 mm ($P < 0.01$), and number of sites with a probing depth ≥ 6 mm ($P = 0.02$).

Unadjusted association measurements between stress and periodontitis showed that there was only association between stress and probing depth ≥ 4 mm. Those patients with a probing depth ≥ 4 mm were 1.26 more likely to be diagnosed with stress than those with a lower probing depth.

After making adjustments for the following confounder covariables, age, sex, schooling level, current smoking habit, pulmonary disease, and body mass index, all models showed a positive association between stress and probing depth ≥ 4 mm, stress and clinical attachment level ≥ 5 mm, and stress and periodontitis. These measurements showed that in individuals exposed to stress the frequency of periodontitis was 15 to 36% higher than those without the condition and this was statistically significant.

CONCLUSION

The findings showed positive association between exposure to stress and the presence of periodontitis, reaffirming the need to prevent and control stress.

Implications for practice

This study with a large sample size provides evidence of an association between stress and periodontitis. However, this does not prove causality. Stress has been identified as a risk factor for both poor general and oral health outcomes.

Reference

1. Coelho JM, Miranda SS, da Cruz SS, et al. Is there association between stress and periodontitis? Clinical Oral Investigations. 2020; 24: 2285-94.

2. Is there an association between periodontitis and all-cause and cancer mortality?

P Chung, T Chan. Association between periodontitis and all-cause and cancer mortality: retrospective elderly community cohort study. BMC Oral Health. 2020; 20: 168.

INTRODUCTION

Periodontal diseases and, in particular, periodontitis is reported to be potentially associated with some systemic diseases and conditions such as cardiovascular disease, the impairment of glycaemic control in patients with diabetes and preterm births or low-birth weight.[1] Such correlation could be due to several mechanisms:

1. The spread of bacteria from the oral cavity could cause tissue damage to various organs.

2. The increase in inflammatory systemic burden that may augment the susceptibility of atheromatous plaque formation.

3. An autoimmune response which could be triggered by bacterial sepitopes from oral bacterial species.[1]

Published studies demonstrated a role of viruses such as Human Papilloma virus (HPV) and Epstein-Barr virus (EBV), that could be detected in periodontal pockets, as suspected agents for oral cancer through the activation of specific oncogenes (such as E6 and E7 for HPV).[1]

Specific pathogens, such as *P. gingivalis*, were demonstrated to prevent, after invading the epithelium, cell apoptosis, thus favouring cancer initiation.[1] These pathogens could be found in carcinomas of the gingiva [18], but could also be associated with distant tumours [21].

Indirect mechanisms for a link between periodontitis and cancer were mainly related to the known association between the inflammatory process itself and cancer. Periodontitis may induce a significant increase in inflammatory markers and molecules that enhances the inflammatory reaction.

This condition causes the release of reactive oxygen species and other metabolites that could promote cancer initiation.[1] Chung and Chan (2020)[2] from Taiwan reported on a retrospective cohort study that sought to assess the association between periodontitis and all-cause mortality, and all-cancer and specific cancers' mortality in a health examination cohort of the elderly in the communities.

MATERIALS AND METHODS

This was a 7-year retrospective cohort study which used a dataset of health examinations for the elderly in Taipei City (Taiwan) with age equal to or above 65 years old.

The study population received an interview, physician consultation and clinical examination. Those aged less than 65 years old ($n = 853$), or with a mis-recorded examination date ($n = 9$) or missing data on periodontal status ($n = 5257$) at the first visit were excluded. Finally, 82,548 study participants were included for further analyses.

The total visits numbered 262,035 as of the end of the study after excluding 26,461 visits with missing data regarding periodontal status ($n = 26,455$) or mis-recorded examination dates ($n = 6$).

For the oral examination, participants with periodontal status reported as "inapplicable" or "refused" were excluded. If participants' periodontal status as diagnosed by dentists showed "no obvious abnormalities" then these participants were classified as having healthy periodontium, while participants with "abnormal periodontal status" diagnosis and periodontal tissues described as "tooth mobility" or "periodontitis" by dentists were classified as having periodontitis.

The primary endpoint was the date of death, especially death from cancer, or the end of the follow-up period (December 31, 2012). The cause of death was recorded according to the International Classification of Diseases, Ninth Revision (ICD-9) or Tenth Revision (ICD-10).

The baseline interview collected age, sex, education level (illiterate, 1-6 years of schooling, 7-14 years of schooling, or above 14 years of schooling), marital status (married and living together, vs. others), self-reported smoking status in the past 6 months (smoked every day, smoked some days or socially, or did not smoke), and self-reported intake of two fruits and three dishes of vegetables daily (yes, no).

If the participant had a history of diabetes or took long-term medication for controlling diabetes, or the fasting blood glucose report revealed abnormality, then the participant was defined as diabetic. In each oral examination, periodontal status was recorded by dentists.

The proportions of participants with different periodontal status at the baseline were calculated separately by demographic characteristics and health behaviors.

Comparisons of baseline characteristics between subgroups according to the periodontal status were made using logistic regression in which the first category in each variable was regarded as the reference group.

Kaplan-Meier curves with the log-rank test were employed to demonstrate the differences in survival curves in subgroups of different periodontal status at the baseline.

At each time point, Kaplan-Meier survival data included the numbers at risk.

A Cox proportional hazards model and Cox frailty model were used for calculating the hazard ratios of all-cause mortality and all-cause cancer mortality under different periodontal status.

After deleting participants who had one or more missing covariates regarding education level ($n = 12,592$), marital status ($n = 1347$), and smoking status ($n = 335$) in the baseline data, the Cox proportional hazards model and the Cox frailty model estimated the hazard ratio for all-cause and all-cancer mortality and included age, sex, education level, marital status, smoking status and periodontal status.

Due to the low number of each specific cancer to test the association, besides periodontal status, the Cox frailty models of deaths from cancer were only adjusted for age and sex.

RESULTS

At baseline, 24,806 participants had periodontitis (30.05%). The mean age of the sample at baseline was 73.59 years, and the slight majority was males (52.15%). More participants had 7-14 years of schooling (43.12%), were not married and living together (72.95%), had not smoked in the past 6 months (90.86%), ate fruits and vegetables daily (77.41%) and were not diagnosed with diabetes (65.8%).

When comparing participants with healthy periodontium to participants with periodontitis, the latter were more likely [$p < 0.05$] to be male (32.98%), be illiterate (32.70%), have higher frequency of smoking (smoke daily 39.82%) and have no fruit and vegetable intake daily (33.10%). However, there was no obvious difference ($p > 0.05$) in the percentages between the healthy periodontium group and periodontitis group by marital status and diabetes. At the end of study, the number of deaths was 11,160 participants, among which about 33.15% had periodontitis.

Association between periodontal status and risk of all-cause mortality and all-cancer mortality

At the midpoint of the study (1500 days), the survival probability of the periodontitis group was lower than that of the healthy periodontium group with regard to both all-cause mortality and all-cancer mortality.

Of the 82,548 participants, 7460 of 57,742 (12.9%) in the healthy periodontium group and 3700 of 24,806 (14.9%) in the periodontitis group died by the end of the study. The estimated rate of overall survival at 3000 days in the Kaplan-Meier analysis was 80.9% (95% CI, 80.1 to 81.8) in the periodontitis group and 82.3% (95% CI, 81.3 to 83.3) in the healthy periodontium group. There were significant differences in the rates of survival between the two groups ($P < 0.001$). Of the 82,548 participants, 2362 of 57,742 (4.1%) in the healthy periodontium group and 1153 of 24,806 (4.6%) in the periodontitis group died from cancer. The estimated rate of overall survival at 3000 days in the Kaplan–Meier analysis was 93.5% (95% CI, 92.9 to 94.1) in the periodontitis group and 94.2% (95% CI, 93.7 to 94.7) in the healthy periodontium group. There were significant differences in the rates of survival among the two groups ($P = 0.004$).

After controlling for other covariates, participants with periodontitis had significantly higher hazard ratios (HRs) for all-cause mortality (HR = 1.077, 95% CI:1.027 to 1.130). Being male, being elderly, and smoking were risk factors for all-cause mortality.

Participants with a high education level (above 14 years of schooling) had lower mortality. In regard to all-cancer mortality, after controlling for other covariates, hazard ratios (HRs) of all covariates had the same trend as that this result was not statistically significant for all-cancer mortality.

With regard to all-cause mortality and all-cancer mortality, there were significant associations with periodontitis. Being male, having a low education level and being a smoker were risk factors for both all-cause mortality and all-cancer mortality when considering each visit.

Association between periodontal status and risk of specific cancer mortality

Comparing mortality of lung cancer in the periodontitis group to the healthy periodontium group, the hazard ratio was 1.185 (95% CI: 1.027 to 1.368) which meant that there was significantly fewer deaths of lung cancer in the healthy periodontium group when compared to the periodontitis group. Similar findings were reported for prostate cancer. No statistical significance was found for esophageal cancer, pancreatic cancer, liver and gallbladder cancer, and colorectal cancer.

CONCLUSIONS

Being male, having a low education level, and being a smoker were risk factors for mortality in this retrospective elderly community cohort study. Our study findings showed mixed evidence that periodontal disease is associated with all-cause, all-cancer and specific-cancer mortality.

Implications for practice

Although the population studied was different to our patients, the large sample size highlight risk factors that may be important in our setting.

Reference

1. Corbella S, Veronesi P, Galimberti V, Weinstein R, Del Fabbro M, Francetti L. Is periodontitis a risk indicator for cancer? A meta-analysis. PLoS One. 2018; 13(4): e0195683.
2. Chung P, Chan T. Association between periodontitis and all-cause and cancer mortality: retrospective elderly community cohort study. BMC Oral Health. 2020; 20: 168.

http://dx.doi.org/10.17159/2519-0105/2020/v75no7a9

Maxillofacial Radiology 183

SADJ August 2020, Vol. 75 No. 7 p395

CJ Nortjé

Figure 1 is a clinical picture of a thirty year old female who presented with a non-ulcerated swelling which has been present for the last eighteen months. The teeth in the region have been extracted ten months ago but the swelling in the left upper jaw increased in size causing nasal obstruction. Figures 2, 3, 4 and 5 are radiographic images of the swelling. What are the important radiological features and what is your provisional diagnosis?

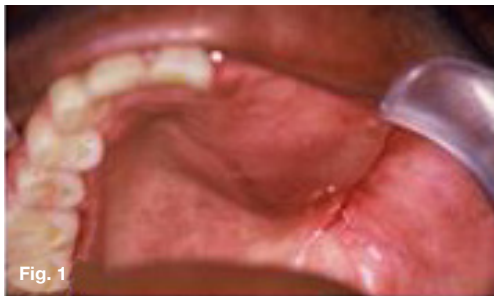


Fig. 1


Fig. 2

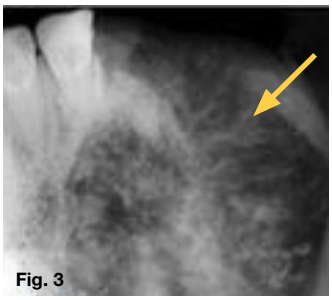


Fig. 3

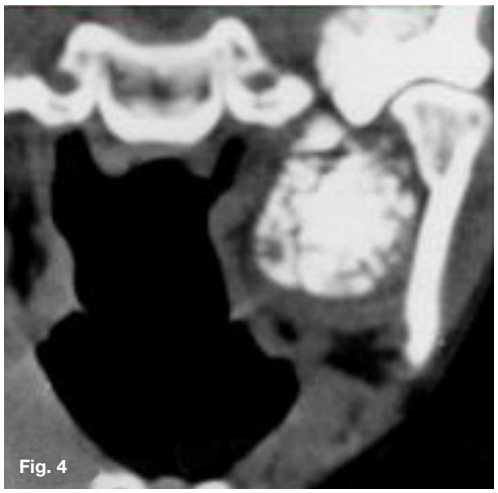


Fig. 4


Fig. 5

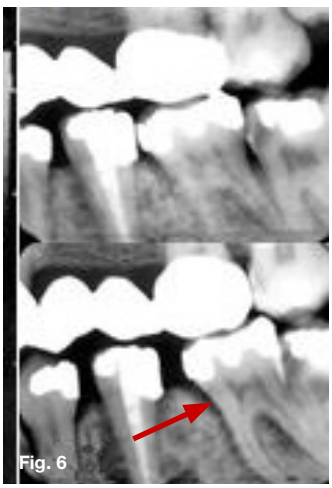


Fig. 6

INTERPRETATION

Looking at the appearance of the remaining teeth in Figure 1, it is unbelievable that the teeth were extracted due to underlying infection. Patients coming from a remote area where modern medical facilities are not available, teeth are mostly extracted in the presence of a swelling without making a proper diagnosis. Figure 2 shows a mixed radiolucent/radiopacity filling the left maxillary sinus extending into the nasal cavity and causing destruction of the left zygomatic arch. Figure 3 is topographic occlusal view of the maxilla presenting with a "sunray" appearance (yellow arrow). Figure 4 is a CT at the level of the mandibular condyle shows a space occupying calcified lesion in the left maxillary sinus. Figure 5 is a coronal CT showing a mixed radiolucent / radiopaque mass in the left maxilla extending into the adjacent nasal fossa and orbit. A histological diagnosis of a chondrosarcoma was made. The chondrosarcoma is a malignant cartilaginous tumour arising *de novo* in bone or soft tissue. The tumour is classified as primary or secondary, depending on whether it arises from a pre-existing benign cartilaginous neoplasm. They are further classified as central (arising inside bone) or peripheral (protruding from bone). Chondrosarcomas com prise 10% or less of primary malignant bone tumours and occur in patients ranging in age from 16 months to 81 years. In the jaws the peak incidence is in the third to fifth decades. Chondrosarcoma are rare in children. In the maxilla anterior sites is favoured, whereas in the mandible the symphysis, coronoid, condylar processes are affected. The cardinal radiographic signs are a mixed radiolucent/radiopaque lesion with periosteal new bone perpendicular to original cortex so called "sunray appearance". Widening of the periodontal ligament space (red arrow) could be an early sign in chondrosarcoma as well as osteosarcoma (Figure 6). Chondrosarcomas normally present as a non-ulcerated lesion whereas osteo sarcoma present mostly as an ulcerated lesion. In my involvement in maxillofacial radiology over the past forty five years collecting approximately 50 cases, I have never seen any patient recovering from an underlying osteosarcoma or chondrosarcoma. Patients normally die as result of metastasis to the lungs.

Christoffel J Nortjé: *BChD, PhD, ABOMR, DSc.* Faculty of Dentistry, University of the Western Cape.
ORCID Number: 0000-0002-9717-5514
Email: cnortje@uwc.ac.za

Reference

1. Farman AG, Nortjé CJ, Wood RE: Oral and Maxillofacial Imaging, 1st Ed, Mosby. St. Louis, Missouri 1993; 286-9.

http://dx.doi.org/10.17159/2519-0105/2020/v75no7a10

COVID-19 in dentistry - Ethical considerations

SADJ August 2020, Vol. 75 No. 7 p396 - p399

R Maart[1], R Mulder[2], S Khan[3]

INTRODUCTION

The reach of Coronavirus Disease - 2019 (COVID-19) has even reached the ethical guidelines for good practice from the Health Professions Council of South Africa (HPCSA).[1]

The health care worker should carefully consider the guidance outlined in several of the booklets as patient treatment has multiple dimensions where COVID-19 had impacted on clinical practice. Due to the nature of dentistry and aerosol generation, special care must be taken when treating healthy patients and patients that are carriers but do not realise that they are COVID-19 positive.

COVID-19 transmission and aerosol dissemination may expose the practice team to hazards of infection. The risk is elevated when implementing aerosol generating procedures without any protective equipment. The oral health care worker (OHCW) and staff thus require the appropriate personal protective equipment (PPE) as suggested by country-specific guidelines, for example, The South African Dental Association (SADA).[2]

To this extent, practicing dentistry in the 21st century is complex[3] and amidst the current COVID-19 pandemic the OHCW is presented with more pitfalls. As the pandemic is showing no sign of abating in SA, this has presented the OHCW with a range of additional ethical considerations.

These dilemmas may be resolved in a variety of ways following an understanding of the basic knowledge of core ethical values and standards for good practice outlined by the HPCSA guidelines.[1]

Author affiliations:
1. **Ronel Maart:** *BChD, MSc,* Senior Lecturer, Department of Restorative Dentistry, University of the Western Cape, Cape Town, South Africa.
2. **Riaan Mulder:** *BChD, MSc, PhD,* Senior Lecturer, Department of Restorative Dentistry, University of the Western Cape, Cape Town, South Africa.
   ORCID Number: 0000-0002-8722-7632
3. **Saadika Khan:** *BChD, MSc, PhD,* Associate Professor, Department of Restorative Dentistry, University of the Western Cape, Cape Town, South Africa.
   ORCID Number: 0000-0001-6017-959X

Corresponding author: Riaan Mulder
Department of Restorative Dentistry, University of the Western Cape, Cape Town, South Africa.
Email: rmulder@uwc.ac.za

Author contributions:
1. **Ronel Maart:** First author - 60%
2. **Riaan Mulder:** Second author - 25%
3. **Saadika Khan:** Third author - 15%

In an attempt to provide guidance to the ethical dilemmas that OHCW might face during this COVID-19 pandemic, ethical reasoning of "what would a reasonable OHCW do" is required. Some of these core ethical values and standards: **respect for patient autonomy, non-maleficence, beneficence** and **veracity** will be highlighted to provide the OHCW with the relevant knowledge to navigate the dilemmas with sound ethical considerations.

Although the exact means the OHCW should consider to navigate various scenarios might change in the coming months with continuous updates from HPCSA, SADA and Dental Protection Limited (DPL), for example, "do no harm" and the "best welfare" to the patient will remain at the centre of such ethical considerations.

PATIENT AUTONOMY

The OHCW should honour the rights of patients to self-determination and confidentiality.[1] During the early stages of the pandemic, SA was quick to respond with a hard lockdown. Level five being the 1st of a series of levels described for lockdown, in an attempt to decrease the rate of spread of COVID-19 and flatten the curve.

This restriction on the country resulted in a dental scope of practice defined and limited to emergency treatment only, where no elective dental procedures were advised to be offered to patients. In order to allow emergency treatment to commence the use of aerosol generation, for example an access cavity, was permitted.

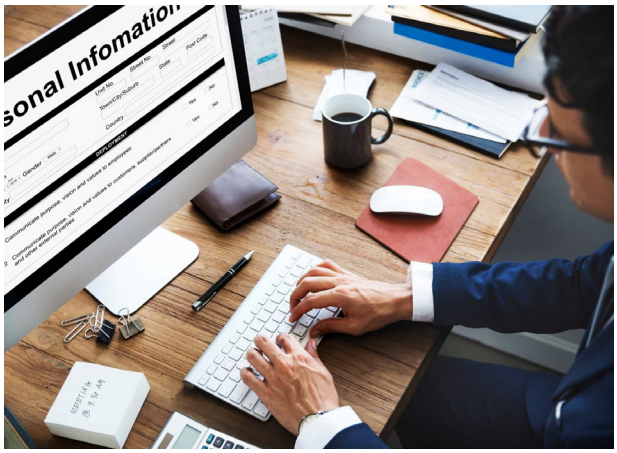
On the basis of the experiences of OHCW in China (Wuhan City), they had to adhere to strict personal protection using appropriate PPE that included the appropriate respiratory PPE.[4] Patients presenting for any dental procedures now as the levels of lockdown change, a pre-treatment screening for any symptoms of COVID-19 symptoms and infection is performed.[2]

The pre-screening session entail OHCW obtaining valid informed consent from each patient after providing them with accurate and clear information about the risks of COVID-19 infection to the them, their family and community.[5] Furthermore, to ensure that the informed consent is valid, the OHCW must also state that the practice is doing everything they can in accordance with guidelines from the National Government as well as SADA to ensure engineering controls are in place and treatment will remain to the ethical guidelines.

SADA has issued a treatment guide prescribed per level of lockdown that offer the OHCW with 80% guidance and the OHCW will use their clinical judgement for the remaining 20% based on their clinical, ethical and situational context.[2]

The safeguard of confidentiality is more complex and needs to be explained to the patient in terms of the COVID-19 dilemma of contact tracing when such a scenario should arise. Under the HPCSA code of ethics, OHCW are obliged to safeguard the confidentiality of patient records.[1] However, this obligation become problematic and even compromised if the need for contact tracing become necessary when the patient or staff member become a Person Under Investigation (PUI).

From the experience drawn from OHCW during the pandemic in Wuhan, every dental procedure was recorded, the contact details (phone number and home address) of patients and accompanying persons. This allowed contact tracing to commence in the event that the OHCW, staff, patients or accompanying person became COVID-19 positive in the subsequent incubation period.[6]



This precautionary measure amidst this pandemic would deem the OHCW to contradict or even compromise the ethical principle of confidentiality. Therefore, the treatment performed on the patient should not be disseminated to respect the patients' privacy and confidentiality, but the contact details to allow contact tracing would be provided to the relevant authorities.

There is therefore an inherent conflict between a patients' interest in confidentiality and that of the public for the protection of individuals from transmission of infectious diseases.[7] The contact tracing is essential to reduce the spread of COVID-19 and to ensure that potentially infected people receive timeous investigations and/or treatment.

Therefore, the OHCW should inform patients of this potential need to share identifiable information in the consent process, should the PUI situation present itself.[5]

NON-MALEFICENCE

Under this ethical principle, the OHCW have an obligation to not harm or act against the best interests of patients.[1] This includes all your patients, staff and their families that are in close proximity to any individual, even those who have been positively diagnosed with or those who are asymptomatic carriers of COVID-19.

The risk of being in close proximity to a COVID-19 patient, presents a scenario to the OHCW that the practice or clinic can become a nexus for further spread of the virus. The American Dental Association (ADA) therefore recommended the cessation of all elective treatment dental procedures.

In light of the potential risk of COVID-19 transmission from either asymptomatic or symptomatic patients, the following standard protocol needs to be considered in your practice or clinic:

- Determining the body temperature of patients on entering.
- Screening patients for emergency dental procedures only.
- Checking whether these patients were presenting any COVID-19 infection related symptoms;
- Establishing whether patients had any exposure to or contact with a PUI and whether patients have travelled from any COVID-19 hotspots (especially during the initial level five lockdown in SA).

In the case of an OHCW that is ill or suspected to be a PUI for COVID-19 infections, the OHCW has an obligation to firstly inform the practice or clinic and its management.

The ADA advised to limit practice to ensure that they do not endanger any patients and other staff.[5] Based on contact tracing the OHCW might become a PUI and need to go into self-isolation until the window-period or the requirements for testing are met. This will allow the management or clinic to engage in appropriate cleansing procedures for the practice to prevent any further contact with infected areas and ensuring the

safety of other patients. The limitation of on-site work activities will also ensure that the practice or clinic do not become a COVID-19 nexus for patients and staff who may add to the local transmission of the virus.[2,5]

When a positive OHCW recover and receive the appropriate number of negative COVID-19 tests, the OHCW may resume their normal duties. The OHCW also have an ethical obligation to immediately inform any patients who may have been potentially exposed within the incubation period of COVID-19, emphasising this principle of "do no harm".

These individuals should be considered as PUI and present for post exposure evaluation and discussion with their human resources department, management and health care providers. In the event that the practice require a complete or partial closure, patients should be accommodated by directing them to another practitioner or provided with a written referral for a colleagues to assist in their continuous treatment, especially in the event of emergency procedures that cannot be provided.

Universal precautions of disinfection, such as the SADA guideline should be followed at all times, and this must be adhered to within clinics or practices where both the dentist and staff strictly observe these protocols to reduce the impact of the practice becoming a COVID-19 nexus. This has become especially pertinent for adhering to the ethical principle of non-maleficence in situations where the PPE as suggested by SADA is not available.[2]

In the SA context, appropriate and sufficient supply of PPE or the absence thereof are realities all health care workers face at some time or another. SA rely heavily on the majority of PPE being imported. Whether to treat a patient or not without the suggested PPE is a major ethical dilemma because all health care professionals have taken the Hippocratic Oath which affirms the obligation to treat patients if and when they need to be treated.

This ethical predicament may be mitigated by following the best available evidence and validated guidelines as suggested from country specific dental organisations, such as SADA and HPCSA, that will allow a safe practice and clinical environment to all that present to these premises.

The HPCSA also recommended that if PPE is not immediately available, then the practitioner should visit the latest information from the National Institute of Communicable Disease[8] but it should not be limited to and should still consider the following items: can treatment be delayed; can additional steps be taken to minimise risk of transmission; and if no other solution can be sought, identify the likely action that will result in the least harm under the circumstances.[9]

What this indicates is that, under such extreme circumstances such as pandemic, normal ethical principles may have to be modified or adapted to allow the OHCW reasonable and best practice liberties to allow treatment without consequences or litigation.

Fortunately, in general dentistry the latter situation will be unlikely to present itself. Nevertheless, the OHCW should at all times ensure a safe working environment as far as reasonably possible. This includes that the employer should provide the necessary resources to keep all staff safe in their working environments.[10,11]

Research on various aspects of COVID-19 is ongoing (though very little clinical evidence is available due to the nature of the condition and health facilities being overwhelmed) and regularly the suggested protocols are updated and refined as knowledge of this pandemic increase and countries are relaxing their economies to return to their altered way of life with COVID-19.

Current ethical guidelines will be redefined, perfected and clarified as the various operational scenarios within countries present themselves. SADA and other dental organisations have a well-established line of communication with members and the relevant information is communicated at regular intervals, which occurs frequently after receiving related information from the country's health authorities and the COVID-19 response team.

BENEFICENCE

Encompasses not to inflict evil or harm, to prevent evil or harm, to remove evil or harm and to promote good or do what they can that would benefit the patient (no harm), while serving the patient and public-at-large. Since the start of the COVID-19 pandemic and when SA entered level 5 lockdown, the OHCW remained available to manage dental emergencies and other procedures based on the suggested guidelines received from SADA.

For the duration of the pandemic, the OHCW remain available and will continue to modify protocols during the different levels the President decides upon using these guidelines. On the basis of relevant guidelines and evidence, dentists should take strict personal protection measures and avoid or minimise procedures where droplet or aerosol production occurs, to protect themselves and the patients they serve.[2,5]

With regards to scarce resources such as PPE, this should be used as per the SADA guidelines where it is required to ensure OHCW and the staff protection.

In the spirit of collaboration and professional courtesy, extra PPE could be shared with colleagues that are experiencing shortages, to promote the well-being of the whole health care community. This kind of actions displayed is indicative of upholding the principle of beneficence.

VERACITY/JUSTICE

Justice as an ethical principle refers to the fairness in health-related decisions that burden or benefit patients, distribution of scarce resources and new treatments.

With the literature on the COVID-19 pandemic, continually becoming clearer, truthful communications with patients remain the best approach.

During such a fluid period, such as a pandemic, misinformation and non-validated news sources will be abundant, it is therefore expected that dental professionals and all OHCW interrogate the evidence and ources of information and only engage with material from reputable journals and organisations.

In the event that a patient require information that you are unable to assist with, be truthful and ensure them that when it becomes available you will communicate it to them. Additionally, as part of the infection control strategies, the practitioner must be weary of advertising and perverse incentives which could harm their patients or not be of any benefit to them.

To this end, with substantial expenses to themselves and their practices, some practitioners are investing in biodecontamination equipment. But the correct use and promotion thereof should be done following proper guidelines, for example, such as those set out by the HPCSA.[12]

CONCLUSION

In addition to understanding the ethical principles discussed above, the moral theory and virtue of ethics support the view that in order to do good, one has to be good[3] and this should be considered as a mantra for this difficult time of running a practice during this COVID-19 pandemic and the uncertainties it presents. According to this moral theory the good OHCW should possess characteristics or virtues such as compassion, integrity, discernment and trustworthiness.[3] This will allow the OHCW to navigate ethical issues underpinned by evidence and by interrogating any related literature as regards to their "moral fibre".

The whole dental practice should be considered to be on the front line with staff support, compassion and empathy as their guiding light. In addition, dental staff should be cognisant of the fact that ethical practices may need to be modified or refined during such unconventional times as a pandemic, with no consequence to them. They therefore need to distinguish between clinical ethics and public health ethics and their role and duties within this environment.

References

1. HPCSA. Ethical guidelines for good practice in the health care professions - Protecting the Public and Guiding the Professions in the health care professions [Internet]. HPCSA; 1-335. Available from: https://www.hpcsa.co.za/Uploads/Professional_Practice/Ethics_Booklet.pdf
2. The South African Dental Association. SADA dental clinical protocol in response to COVID-19 Pandemic SADA dental clinical protocol in response to the COVID-19 Pandemic 2020: A South African Private Practice Perspective Dentistry Is Potentially Dangerous for Ourselves, Our Patients and Our S [Internet]. 2020. Available from: https://cdn.sada.co.za/files/clinical-resources/downloads/coronavirus/SADA Dental Clinical Protocols in Response to the COVID-19 Pandemic 2020 A South African Perspective Final Draft 10-5-2020.pdf?v=20200529142823.
3. Naidoo S, Moodley K. Ethics and the Dental Team. Van Schaik Publishers; 2010. 1-144.
4. Mulder R, Layloo N, Mulder van Staden S. COVID-19: Focus on masks and respirators – Implications for oral health-care workers. SADJ. 2020; 75(4): 175-82.
5. ADA. Guidance on Continuing to Practice Ethically during COVID-19 Guidance on Continuing to Practice Ethically during COVID-19 [Internet]. 2020. Available from: https://success.ada.org/~/media/CPS/Files/COVID/ADA_COVID_How_Do_I_Ethically_See_Patients_During_Pandemic.pdf.
6. Meng L, Hua F, Bian Z. Coronavirus Disease 2019 (COVID-19): Emerging and Future Challenges for Dental and Oral Medicine. JDR. 2020; 99(5): 481-7.
7. Naidoo S, Vernillo A. Ethical and Legal Issues on HIV Testing, Policy and the Practice of Dentistry. J Forensic Odontostomatol. 2012; 30(2): 7-16.
8. National Institute of Communicable Disease. National Institute of Communicable Disease: COVID-19 [Internet]. National Institute of Communicable Disease. 2020. Available from: https://www.nicd.ac.za/.
9. HPCSA. COVID-19 Outbreak in South Africa: Guidance to Health Practitioners [Internet]. 2020. Available from: https://www.hpcsa.co.za/Uploads/Events/Announcements/HPCSA_COVID-19_guidelines_FINAL.pdf
10. Republic of South Africa Parliament. No. 61 of 2003: The National Health Act, No. 61 of 2003. Vol. 469, 23 July 2004 No. 26595. [Internet]. Available from: http://www.gov.za/sites/ww.gov.za/files/a61-03.pdf.
11. Republic of South Africa. No 85 of 1993: Occupational health and Safety Act as amended by Occupational Health and Safety Amendment Act, No. 181 of 1993.
12. Health Professions Council of South Africa. Guidelines on Overservicing, Perverse Incentives and Related Matters. Booklet 5, Professional Conduct & Ethics [Internet] Hpcsa.co.za 2020. Available from: http://www.hpcsa.co.za/conduct/Ethi.

CPD questionnaire

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

GENERAL

Oral health care for patients undergoing therapy for head and neck cancer in KwaZulu-Natal, South Africa - A qualitative study

1. Identify the CORRECT answer. The common oral complications associated with head and neck cancer (HNC) include:
   A. Oral mucositis, xerostomia, taste disorders and pain
   B. Dysphagia and odynophagia
   C. A and B
   D. None of the above

2. Identify the CORRECT answer. Oral health-related management for the patient with HNC should be available:
   A. prior to cancer therapy
   B. during the cancer treatment phase
   C. post cancer treatment
   D. All of the above

3. Identify the CORRECT answer. The perceived lack of referral pathways for oral health management could possibly be due to:
   A. health workers having inadequate oral health-related knowledge and skills for patient management
   B. lack of awareness of the role of oral health workers in the management of HNC
   C. A and B
   D. health workers having poor attitudes towards oral health care

Development of a tool to measure patient expectations with complete removable dentures

4. Identify the CORRECT statement. The patient expectation questionnaire is based on conceptual subscales that include:
   A. physical disability, physical pain, psychological disability and the handicap of the patient
   B. functional limitation, physical disability, physical pain, psychological disability and the handicap of the patient
   C. Functional limitation, physical disability, psychological disability and the handicap of the patient
   D. Functional limitations, physical pain, psychological effects, social effect of denture wearing, handicap of the patient

5. Identify the CORRECT statement:
   A. Patients with an internal locus of control see the events of their life primarily because of their own actions and behaviour
   B. Patients with an internal locus of control see the events of their life as circumstances out of their control
   C. Patients with an internal locus of control usually do not have high levels of expectations and lack determination
   D. Patients with an external locus of control believe in controlling their destiny and relying on their personal skills and efforts

The effect of A-dec ICXTM on microbiological water quality in self-contained dental units' water systems

6. Identify the CORRECT answer. The common approaches to improve water quality include:
   A. self-contained water systems combined with periodic or continuous chemical treatment protocols
   B. air purging regimens
   C. anti-retraction valves
   D. All of the above

7. Identify the CORRECT answer. The Centers for Disease and Control Prevention (CDC) standard for water quality used in non-surgical dental procedures is:
   A. 200 cfu/ml
   B. ≤500 cfu/ml
   C. 1000 cfu/ml
   D. 5000 cfu/ml

8. Identify the CORRECT answer. The baseline mean bacterial count of the dental units recruited into this study was:
   A. 500 cfu/ml
   B. 18000 cfu/ml
   C. 30000 cfu/ml
   D. 240000 cfu/ml

The 'Digital Access Divide' at a South African Dental School – A cross-sectional study

9. Identify the CORRECT answer. Problems with internet /digital learning for students include:
   A. Inadequate Internet speed
   B. Accessing unreliable information
   C. High data costs
   D. All of the above

10. Identify the CORRECT answer. The biggest division between students was:
    A. with regards to those who owned mobile digital devices and those who didn't
    B. those who lived at home and those who lived in residences
    C. access to internet facilities and affordability of this off campus
    D. year of study and internet needs

11. Choose the CORRECT answer: Problems encountered by many dental students include:
    A. No internet at home
    B. No access when needed after hours
    C. No personal computer or laptop
    D. Only A and B above

12. Identify the CORRECT answer. Online teaching in dental schools has:
    A. Not been common due to the clinical nature of the course
    B. Not been common due to costs and logistics of use
    C. Become necessary due to the recent Corona outbreak
    D. All of the above

Dental students' self-perceived competency and usage of the internet for learning and evaluation purposes

13. Identify the CORRECT statement. Flipped learning involves:
    A. Students giving the lectures to the class
    B. Students learning from flip-charts
    C. Students doing some pre-class preparation
    D. Students evaluating their own work

14. Identify the INCORRECT statement. The internet:
    A. allows for easy access to all kinds of information
    B. provides quick and direct access to information
    C. is a secure and reliable means for communicating
    D. allows for information exchange

15. Identify the INCORRECT statement. In this study students were the most competent when using the internet:
    A. for accessing relevant literature
    B. for downloading videos
    C. for sharing data with their friends
    D. for submitting short quizzes

A giant submandibular sialolith – How to manage?

16. Identify the CORRECT statement. Which salivary gland is the most prone to form sialoliths?
    A. Parotid
    B. Submandibular
    C. Sublingual
    D. Minor Salivary glands

17. Identify the CORRECT statement. Submandibular calculi are best diagnosed and localised by:
    A. plain radiograph – IOPAR
    B. plain radiograph – Oblique view
    C. CT Scan
    D. Xray Skull lateral view

18. Identify the CORRECT statement. Which structure is more prone to get damaged during transoral sialolithotomy of submandibular gland?
    A. Marginal mandibular branch of Facial Nerve
    B. Lingual Nerve
    C. Lingual Vein
    D. Facial Artery

Clinical Window: What's new for the clinician?

19. Identify the CORRECT answer. In the Coelho et al. study, results showed that participants with stress, compared to those not exposed to this condition were:
    A. more frequently male
    B. more frequently female
    C. equally males and females
    D. None of the above

20. Identify the CORRECT answer. In the Chung and Chan study, choose the factors that were found to be significant risk factors for all-cause mortality.
    A. Being male, being elderly, and a smoker
    B. Being male, consuming alcohol and a smoker
    C. Being female, being elderly, and a smoker
    D. Being female, consuming alcohol and a smoker

ETHICS

COVID-19 in dentistry - Ethical considerations

21. Identify the INCORRECT statement. Informed consent is valid when the OHCW can ensure:
    A. that the practice is compliant with COVID-19 related guidelines
    B. the appropriate COVID-19 engineering controls are not in place
    C. that treatment will remain ethical
    D. that the patient is informed to share their contact information for contact tracing if COVID-19 exposure was likely

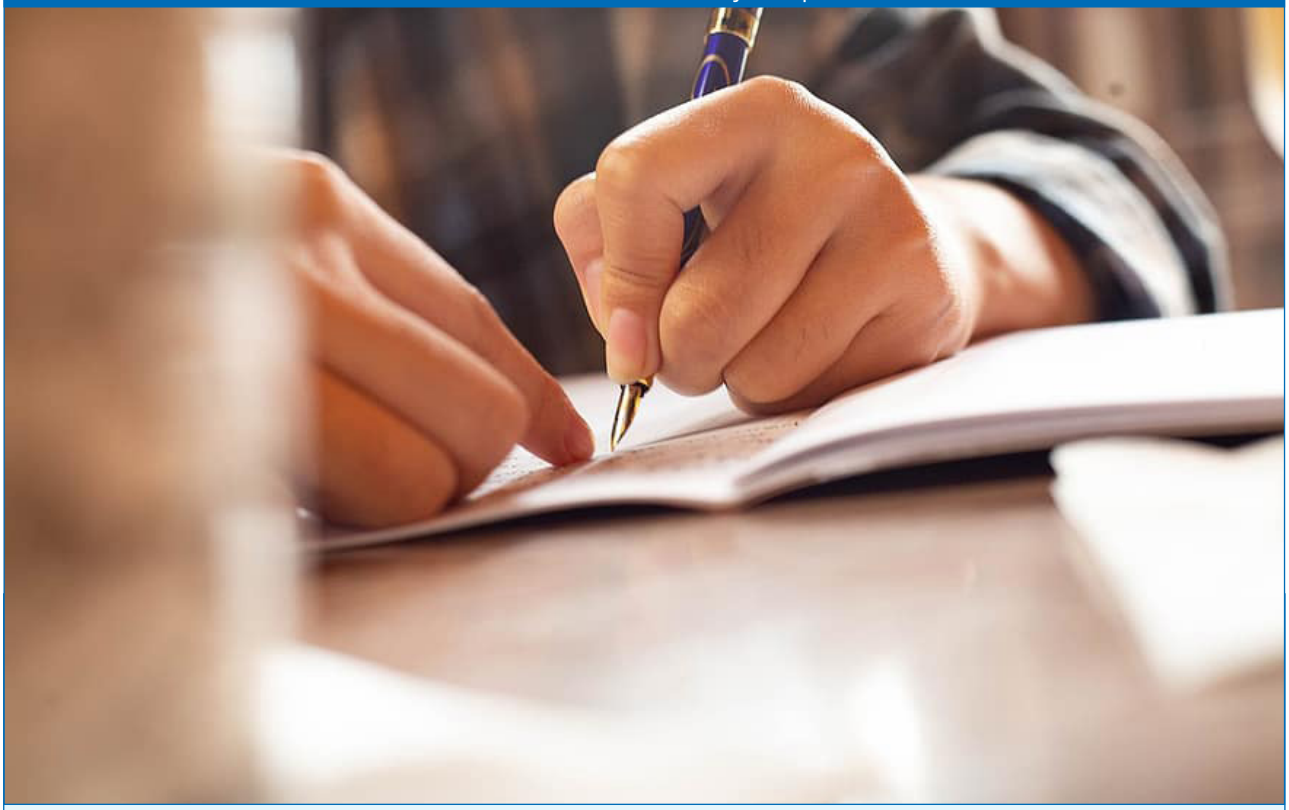
22. Identify the INCORRECT statement. Considering the practice or clinic can become a nexus for further COVID-19 spread, the OHCW should apply "non-maleficence" to:
    A. only the patient that is COVID-19 positive
    B. all patients exposed after the COVID-19 patient
    C. all staff in the practice/clinic
    D. the families of all staff

23. Identify the CORRECT statement. It is the ethical obligation to protect staff and patients. Therefore, the OHCW should have the correct PPE to continue all spheres of practice. If the appropriate PPE is not in place the OHCW can apply "Beneficence" by:
    A. continuing practice as normal
    B. staggering all COVID-19 patients together
    C. deferring procedures until the correct PPE is in place
    D. opening a window and continuing as normal

24. Identify the INCORRECT statement. For an OHCW to uphold the principle of beneficence the following does NOT serve as an example:
    A. Using PPE correctly as per the SADA guideline for procedures
    B. The OHCW should remain available in pandemic situations to treat patients where possible
    C. Not sharing PPE with other colleagues in desperate need
    D. The OHCW should modify protocols and follow the SADA guideline during the different levels of lock-down.

25. Identify the CORRECT statement. The ethical principle of "Justice" refers to the fairness in health-related decisions that burden or benefit patients. To this extent the OHCW should ensure:
    A. They interrogate the evidence and reputable sources for information
    B. They do not disclose and discuss COVID-19 related challenges of the practice/clinic with patients
    C. Be wary of advertised products and ensure there is evidence to the claims made
    D. Be wary of perverse incentives which could harm the patients or not be of any benefit

Online CPD in 6 Easy Steps



1 Go to the SADA website www.sada.co.za.

2 Log into the 'member only' section with your unique SADA username and password.

3 Select the CPD navigation tab.

4 Select the questionnaire that you wish to complete.

5 Enter your multiple choice answers. Please note that you have two attempts to obtain at least 70%.

6 View and print your CPD certificate.

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

Instructions to authors

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

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

We shall be obliged if your submission is prepared respecting all the details listed in these Instructions. This facilitates our process and ensures more rapid responses to you. Please use and submit the Checklist for Authors suplied **on page 406** for confirmation. Thank you.

Address for submission of articles

The Editorial Assistant, Mr Dumi Ngoepe,
South African Dental Journal, South African Dental Association (SADA), Private Bag 1, Houghton 2041, South Africa.
Email addresses: ngoeped@sada.co.za
bill.evans@wits.ac.za
Please submit the paper in electronic format in Word and Figures sparately in JPEG., accompanied by a covering letter signed by the author(s).

Language

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

Clinical Research

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

Clinical Trials

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

Authors

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

1. Substantial contributions to the conception or design of the work or the acquisition, analysis or interpretation of data for the work, AND
2. Drafting the work or revising it critically for important intellectual content, AND
3. Final approval of the version to be published, AND
4. Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved (www.icmje.org).

- The front page of the manuscript should list the title of the article, the author's(s') name(s), and their qualification(s), affiliations and positions held, telephone and fax numbers and address(es), including Email address(es), if available. It is especially important that details of the Corresponding Author should be clearly stated.
- Please submit on the front page a list of up to eight Keywords.
- In the case of multiple authors, the role played and the respective contribution made by each should be recorded. For example: "Principal Researcher- 40%, Writing Article- 30%, Tissue Analysis- 20%, Microscopic Examination- 10%", etc.
- A recent requirement is that authors should be registered with ORCID. This is a number registering you as an Open Researcher and Contributor. Go to the ORCID website home page at https://orcid.org/ and follow the Three Easy Steps indicated in green. Please submit the ORCID number with your author details.

Title

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

Abstract

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

Text

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

Length of the article

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

Illustrations/graphics/photographs

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

tained from the holder of copyright and a copy of the agreement must be submitted with the article. Suitable acknowledgement must be recorded in the article.

Continuing Professional Development

Please supply **4-5 Multiple-choice Questions (MCQ's)** with 4 or 5 options per question related to your article. Questions must have only one correct answer, and indicate this correct answer clearly.

References

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

Journal references should appear thus:

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

Book references should be set out as follows:

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

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

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

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

Declaration

All sources of funding, possible financial interest/s or incentives in products or services mentioned in the article must be disclosed. Authors are kindly requested to read and sign the attached declaration **on page 405**.

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

Ethics

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

Conflict of interest

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

Copyright

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

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

Submission

The paper should be submitted in one file including all Tables and Figures and their accompanying Legends Figures should also be submitted separately file in JPEG. format.
Please submit the paper in electronic format in Word along with separate Figures in JPEG. format to: ngoeped@sada.co.za and to bill.evans@wits.ac.za, accompanied by a covering letter and the Declaration **on page 405** signed by all the author(s).

Galley proofs

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

Editorial Policy

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

Enquiries

Enquiries regarding Journal matters can be directed to
Mr Dumi Ngoeped, Editorial Assistant, at SADA headquarters on:
Tel: +27 (0)11 484 5288, Fax: +27 (0)11 642 5718,
Shared Line +27 (0)86 011 0725 or Email: ngoeped@sada.co.za.

Declaration by Author/s

Title: _____

_____

Author/s: _____

_____

I/We, the undersigned confirm and declare that:

1. This manuscript is my/our original work and I am/we are the owner/s of this manuscript and possess rights of copyright.
2. I/we confirm that this manuscript has not been published previously and it is not currently considered for publication elsewhere. Has this article been submitted to any other journal and if so, has it been rejected? **YES** ☐ **NO** ☐
3. For no consideration or royalty, I/we hereby assign, transfer and make over to SADA all the rights of copyright, which have or will come into existence in relation to this manuscript.
4. I/we waive in favour of SADA or any successors in title any moral rights which may be vested in me/us.
5. The manuscript does not constitute an infringement of any copyright and I/we indemnify SADA against all loss or damage, from any cause arising which SADA may sustain as a result of having been granted copyrights to the manuscript.
6. The research has been approved by the Ethics Committee of my/our institution/s or the Ethics Committee/s of other accredited research facilities.
7. I/we have disclosed in my/our Acknowledgments all sources of funding, possible financial interest/s or incentives in products or services mentioned in the paper.

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

Author's Checklist

Have you read the Instructions to Authors?	☐
Are you submitting electronically?	☐
Have you provided all author information including first names, affiliations, qualifications, positions held, Department and Institution, ORCID number, contact details?	☐
Is the first author under the age of 35 on submission of the article?	☐
Have you provided all details of the Communicating Author?	☐
Have you submitted questions for the CPD section? (four or five multiple choice, one correct answer)?	☐
Have you submitted details of the contribution of each author... can be percentage or descriptive... or both?	☐
Have you confirmed the status of your paper in terms of any Conflict of Interest?	☐
Have you submitted the Clearance Certificate number when Ethical permission has been required to undertake research or to publish data?	☐
Does the paper adhere to the format requested in Instructions to Author?	☐
Are the references quoted according to Journal policy, both in the text and in the list of references?	☐
Have all authors signed the Letter of Submission?	☐

Smalls advertising and placement procedure

- All smalls advertisements are restricted to a **maximum 100 words** per advertisement.
- All advertisement requests are required in writing, **submit to abayman@sada.co.za**, with full contact details of the advertiser which should include:
  - the wording of the advertisement as you require it to be published;
  - the members professional number; (will not be published);
  - the members contact details (will not be published).
- Advertisement **lifespan is two weeks** from the date of upload.
- Advertisements to be **repeated follow the same process** as the original placement request.
- All advertisements which **exceed a word count of 100** words will be forwarded to our **publishers E-Doc** for further processing as a potential advertisement to be placed in the SADJ electronically or as website advertising. E-Doc will contact you thereafter regarding your requirements.
- **SADA Members** may place advertisements at no cost providing their annual membership fees are either paid in full at the time of their request of a debit order request has been lodged.
- **Non-SADA Member** advertisers will be charged R25 per word for placement of their advertisements.
- Advertisement must be paid in full prior to uploading on the web platform.
- Invoice may be settled telephonically with the use of a credit card to prevent delay of placement.
- **Telephonically processed** payments will result in uploading of advertisement within **24 hours** of settlement.
- Advertiser remains liable for placement costs should payment be dishonoured and invoice remains unpaid.

Contact details:
Ann Bayman
South African Dental Association
Tel: +27 (0)11 484 5288
Email: abayman@sada.co.za

SADA
THE SOUTH AFRICAN DENTAL ASSOCIATION

www.sada.co.za