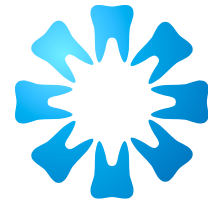


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THE SOUTH AFRICAN  
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*The Green Man*



*The Green Man*

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## CONTENTS

## EDITORIAL

The importance of evidence in evidence-based care - *N Wood* 455

## COMMUNIQUE

September - Oral Health Month - *N Metsing* 456

## RESEARCH

Dental implant imaging: What do South African specialists prefer? - *KR Beshtawi, MT Peck, HM Mahmoud, M Chetty* 448Detrimental orofacial manifestations of dengue and dengue hemorrhagic fever - *SR Dutta, P Singh* 457Clinicopathological evaluation of focal reactive lesions of the Gingiva - *C Karuma, S Ngwenya, S Shangase* 465Safe administration of oral Midazolam and nitrous oxide gas for paediatric patients - *N Potgieter, G Streit* 471Deep neck space infections in Adolescents - *S Maharaj, S Mungul* 477Dental educators' views and knowledge of competencies - *RD Maart, RZ Adam, JM Frantz* 482

## Our Front Cover for this Issue...

The theme for the Front Cover of the South African Dental Journal this year showcases various types of masks. Masks have been admired and worn throughout the world for centuries and play an integral part of many activities including customary rituals, cultural events, battles, entertainment, and for protection. The cover for September features the symbolic archetype of the Green Man.

**The Green Man**

A Green Man is a representation of a face surrounded by a mask of leaves, shoots, flowers or fruit. He is found in many cultures and is primarily interpreted as a symbol of rebirth, renewal and growth. It is likely that Green Man pillars were originally erected on the sites of sacred trees where he signified irrepressible life which seems to die and then come back to life after long forgotten periods. The archetype often re-emerges in Spring, perhaps acting as a symbolic challenge for us to heal our relationship with nature and with each other.

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# CONTENTS

## CLINICAL WINDOW

What's new for the clinician? - Excerpts from and summaries of recently published papers - *V Yengopal* 492

## RADIOLOGY CASE

Maxillofacial Radiology 193 - *C Nel, Z Yakoob* 496

## ETHICS

Grillz and Gold Teeth – Aesthetics, Economics and Ethics  
- *TM Mtolu, PD Motloba* 498

## CPD

CPD questionnaire 501

## AUTHOR GUIDELINES

Instructions to authors and author's checklist 504

## CLASSIFIEDS

www.sada.co.za - Smalls advertising placement procedure and rules 508

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# The importance of evidence in evidence-base care

SADJ September 2021, Vol. 76 No. 8 p445

**Prof NH Wood**  
**Managing Editor of the SADJ**



In an era where scientific discovery has exploded, and where rigorous quality assurance and quality control mechanisms are applied in the discovery of knowledge, we still face many challenges from people who would deliberately provoke and perpetuate falsehoods to circumvent or even contradict fact-based interventions and policies. This is not a matter of mere scientific hesitancy which is ameliorated by sharing of knowledge and information, but a clear and purposeful opposition to fact. The reasons for this remain largely unclear, but to the scientific community it becomes a daily struggle to advocate for what is correct and just.

We learn and experience early in our scientific careers through the application of the scientific method that we are inherently sceptic. We design ways of approaching problems or challenges from different aspects, and whenever we appear to have an answer, we replicate the process and introduce confounding factors and/or additional variables. We scrutinize for bias; we meticulously record our methods for the sake of examination and replication by other independent scientists who could confirm or disprove our hypotheses. We consult widely, build on the peer-reviewed work of those before us, and ultimately submit our own conclusions for scrutiny and criticism by strangers. We do not form an opinion based on feelings or select anecdotal evidence and then propagate that as our answer or solution to any given challenge. Furthermore, whenever new evidence is discovered and introduced into a system, it will prove or disprove theories, policies, or current practice, and adjusts our approaches to maintain an evidence-based foundation.

As scientific contribution advances, some knowledge acquired through this process becomes the foundation for subsequent experimentation, development, and problem-solving. This leads to complex and intricate challenges being addressed in many fields of medicine and dentistry, but at the same time sees scientific progress and development challenged by naivety and even suspicion. The most current and practical example of this is the challenge to vaccination against the SARS-CoV-2 virus and its variants.

In dentistry, a discipline that is firmly rooted in science and scientific progress, there is no room for any antivax sentiment when this intervention is supported by overwhelming evidence in favour of safety and efficacy. It is also questionable whether ethical care can be



provided to patients and communities when practitioners selectively pick and choose what science they “believe” in, and what not. When fearmongering and antivaccination propaganda is rife, healthcare practitioners have an ethical obligation to provide the best standard of care. This is always informed by evidence, and disregarding evidence-based practice is unacceptable. It also brings into question whether any such practitioners would disregard evidence-based practice in other components of their professional development and service delivery to their patients. The implication is then that personal bias and misinformation informs their practice and interactions with others. Does such a practitioner provide ethical care?

It is without a doubt incumbent on us to educate and disseminate knowledge and information. In terms of a public health intervention developed and researched over many decades, we need to be up to date with the current evidence and apply this intervention in our own lives and practice – it’s right there in the name “public health”. If anyone claims to “do their own research” let it be submitted and scrutinized as per the scientific method, and if it stands up to the process, it will be published and presented to the scientific community to inform and adjust policy based on evidence.

Neil H Wood: Managing editor. Email: [neil.wood@smu.ac.za](mailto:neil.wood@smu.ac.za)

**Please, get vaccinated.**

# September - Oral Health Month

SADJ September 2021, Vol. 76 No. 8 p446

Dr Nthabiseng Metsing, Head: Professional Development, SADA

The month of September is national Oral Health Month and it is during this time where pay special attention to encouraging society to take time to pay extra attention to their oral health routine, principally with the knowledge that two of the world's most common health problems affect the mouth these being cavities (dental caries) and gingivitis & periodontitis (gum disease).

Gum disease ranks second only to the common cold in terms of prevalence, with an estimated 90% of South Africans experiencing the problem at some point.

It really is in the patients' best interest to practice good oral hygiene. Not only does it ensure a beautiful smile, but it is good for their general health – gum disease has been linked to coronary heart disease, adverse pregnancy outcomes and diabetes. And new research also shows that women with gum disease find it harder to conceive. (South African Health Department)

Over the past few years SADA had decided to take oral health to the people and start them young by doing outreach programs in schools all over the country. Over the past 2 year with the dawn of the Covid-19 pandemic we have had to effect changes in how we have educated society. Since there is no contact and crowd gatherings permissible, we have had to reach out to the public through online methods of engagement. This year we decided to focus on oral lesions (benign and malignant) and periodontal diseases for the month of September.

The selection of this topic was led by the realisation that there is serious lack of knowledge around these conditions and this is creating a huge burden on the tertiary institutions because patients present at really advanced stages of the diseases. Often leading to treatment modalities that are very extensive.

Cancer is one of the most common diseases affecting humans worldwide. Despite the latest advances made in molecular and cell biology, how cancer cells progress through carcinogenesis and acquire their metastatic ability is still questionable. The oral cavity is one of the most common sites for potentially malignant disorders. These premalignant pathologies may progress to dysplastic lesions then to invasive carcinomas.<sup>1</sup>

Lymphoma is the third most common malignancy worldwide representing 3% of all malignant tumours. With 12% of all malignant tumours of the head and neck region, lymphomas are the third most frequent malignancy after squamous cell carcinoma (46%) and thyroid carcinoma (33%) and should thus always be taken into consideration in cases of unknown cervical or oral masses. Misinterpretation of the clinical appearance and of the radiological findings (ultrasound, CT-scan, MRI) can lead to delay in diagnosis, delayed treatment initiation and impairment of the patient's prognosis.<sup>2</sup>

It is very important for oral health practitioners to orate prevention to their patients because most of the head and neck

cancers are lifestyle related and very preventable. Lifestyle refers to the way individuals live their lives and how they handle problems and interpersonal relations. The lifestyle behaviours associated with oral cancer with convincing evidence are tobacco use, betel quid chewing, alcohol drinking, low fruit and vegetable consumption (the detrimental lifestyle is high fat and/or sugar intake, resulting in low fruit and/or vegetable intake). Worldwide, 25% of oral cancers are attributable to tobacco usage (smoking and/or chewing), 7–19% to alcohol drinking, 10–15% to micronutrient deficiency, more than 50% to betel quid chewing in areas of high chewing prevalence. Carcinogenicity is dose-dependent and magnified by multiple exposures. Conversely, low and single exposures do not significantly increase oral cancer risk. These behaviours have common characteristics: (i) they are widespread: one billion men, 250 million women smoke cigarettes, 600–1200 million people chew betel quid, two billion consume alcohol, unbalanced diet is common amongst developed and developing countries; (ii) they were already used by animals and human forerunners millions of years ago because they were essential to overcome conditions such as cold, hunger, famine; their use was seasonal and limited by low availability, in contrast with the pattern of consumption of the modern era, characterized by routine, heavy usage, for recreational activities and with multiple exposures; (iii) their consumption in small doses is not recognized as detrimental by the human body and activates the dopaminergic reward system of the brain, thus giving instant pleasure, "liking" (overconsumption) and "wanting" (craving).

With the above background, one was trying to demonstrate the severity of these oral lesions and to also emphasise the fact that if oral healthcare workers do not play their part society will suffer gratuitously.

The time has come for oral health practitioners to increase their efforts in raising awareness about these debilitating oral conditions, many of which can be avoided if patients are sufficiently encouraged to make different lifestyle choices. Oral health practitioners are also encouraged to be mindful of even the smallest lesions and treat or refer these patients timeously. Most of the time oral healthcare practitioners are the only ones who will get the opportunity to do a thorough examination of patients' oral cavities and most times that may be the patients' best chance of getting these lesions detected. So, during this Oral Health Month we beseech all oral healthcare workers to do their best to spot all possibilities of patients developing more serious oral conditions before it is too late. Let us be part of the change that we want to see, the wellbeing of our patients may rely on it. Let us reduce the burden that these conditions can pose on the already ailing health system.

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# Dental implant imaging: What do South African dentists and dental specialists prefer?

SADJ September 2021, Vol. 76 No. 8 p448 - p456

KR Beshtawi<sup>1</sup>, MT Peck<sup>2</sup>, HM Mahmoud<sup>3</sup>, M Chetty<sup>4</sup>

## ABSTRACT

### Aims

To document the types of imaging modalities that are commonly prescribed during dental implant therapy in South Africa.

### Material and methods:

The radiographic preferences were obtained from practitioners via an electronic survey that was disseminated during local dental conferences, electronic channels (e.g., email lists) of multiple dental schools and local dental scientific societies, and personal interviews. The survey consisted of multiple-choice questions which were designed to investigate the most common radiographic prescriptions during various treatment phases of implant therapy.

### Results

The responses of one hundred and forty-two participants (General practitioners and dental specialists) practising in different South African provinces were collected and assessed. Principally, panoramic radiographs combined with cone beam computed tomography (PAN + CBCT) followed by CBCT, as a single examination (ASE), were the most preferable modalities during the implant planning phase (39% and 29%, respectively). During and directly after the surgery, periapical radiographs (ASE) were the most preferred (87% and 65%, respectively).

### Conclusion

The most widely preferred radiographic examination during

the planning of implants was panoramic radiographs combined with CBCT. Periapical radiographs (ASE) were favoured during, directly after the treatment, and during the follow-up of asymptomatic patients by the majority of participants. However, CBCT (ASE) was preferred in the follow up of symptomatic patients. Factors related to extra anatomical information and superior dimensional accuracy provided by three-dimensional volumes (e.g., CBCT volumes), were the most indicated influencing factors on the radiographic prescriptions during implant planning.

### Keywords

Dental implant, radiographic prescription, survey, CBCT.

## INTRODUCTION

Dental radiology is an integral part of dental implant therapy, providing information on the anatomy, boundaries, possible jaw pathologies, and remaining bone quantity and quality of the potential implant site.<sup>1,2</sup>

Various imaging modalities can be utilized during implant therapy with panoramic radiographs being widely used.<sup>2</sup> During implant treatment, the use of panoramic radiographs was reported<sup>3-5</sup>, and even as a single examination.<sup>6</sup> The panoramic radiographs do provide multiple advantages which include lower costs, reduced radiation exposure (compared with three-dimensional modalities), ease of use, and availability.<sup>3-5</sup>

Cone-beam computed tomography (CBCT) is a relatively recent and promising technology that has become increasingly popular during various dental treatments including implant placements.<sup>7</sup> This modality provided a three-dimensional perspective on the surgical site while exposing the patients to dosages that are much less than Computed Tomography (CT).<sup>7</sup>

Multiple organizations and scientific committees have released guidelines/advisory recommendations which are specific for a geographical region (e.g. the American Academy of Oral and Maxillofacial Radiology (AAOMR), the European Association for Osseointegration (E.A.O.), the European Commission, the International Congress of Oral Implantologists (ICOI)).<sup>2,8-11</sup> There is a paucity of compelling evidence to support the efficacy of using cross-sectional radiographic techniques over conventional counterparts (i.e. 2D imaging) during implant planning.<sup>2,7,12</sup> Treatment methodologies and information acquired from educators

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2. **Analysis:** KR Beshtawi, HM Mahmoud
3. **Writing – Original Draft:** KR Beshtawi
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5. **Supervision:** M Chetty, MT Peck



at various educational levels, competent knowledge of handling recent imaging modalities, and economic strains influence a clinician's radiographic prescription.<sup>13</sup>

In South Africa (SA), CBCT was reported to become a common procedure and even a routine procedure in some practices for screening purposes.<sup>14</sup> This is especially true particularly with the absence of rigorous local radiographic guidelines which could inform specific criteria for the management of patients requiring implant therapy. In this article, the authors report on the radiographic prescriptions, preferences and clinical opinions of a sample of dental practitioners who perform implant therapy in various South African provinces.

## MATERIAL AND METHODS

An electronic questionnaire was developed and published online using Google® Forms® after obtaining ethical approval for degree purposes (Number: BM19/1/20, University of the Western Cape, South Africa). The survey was constructed with 17 open-ended multiple-choice questions. All the information with respect to the research and the questionnaire (information sheet) was attached to the beginning of the online survey. A consent form was presented at the beginning of the online survey. No names nor personal information was required and anonymity of the participants was maintained.

The questions were formulated to allow for anonymous and scenario-based investigations on the radiographic analysis executed/preferred during implant therapy in South Africa (in various phases of the treatment). The questions probed data on the most used imaging modalities, personal experiences, clinical preferences, and the possible factors that may influence radiographic prescriptions. Only two questions were allowed to record multiple selections (answers). The level of formal training received (e.g., general dentist, postgraduate student, specialist) and the province where participants practised, were captured.

The imaging modality preferences were assessed during different clinical situations, various anatomical regions, and embraced all the phases of dental implant therapy (planning, intra-operative, and follow-up phases). The anatomical regions that were assessed during the planning phase include the posterior mandible (unilateral, distal to first premolar region), anterior region of the maxilla/mandible (canine to canine region), posterior maxillary region (unilateral: distal to the first premolar), one jaw (mandible/maxilla) or both jaws (full mouth), and the mental foramen region (uni/bilateral). The imaging modalities options were: periapical radiograph/s (PA) only, panoramic radiograph (PAN) only, PAN + PA, PA + CBCT, PAN + CBCT,

CBCT only, and no radiographs. Motivating factors for the selection of radiographic examinations, such as cost, availability, radiation dose concerns, broad coverage (i.e., the extent of the anatomical area depicted in a single radiographic examination), dimensional accuracy (3D volumes), additional anatomical information (3D volumes), and special procedures (e.g., 3D volumes for guided implant surgery) were also explored.

### Inclusion criteria:

1. Clinicians, academics, specialists, and senior residents in the Departments of Periodontology, Prosthodontics, Oral maxillofacial surgery, and Oral and Maxillofacial Radiology, who are engaged in dental implant therapy in the South African dental schools.
2. Dental specialists who perform implant treatments in private practice.
3. Dental practitioners in private practice with experience performing dental implantology not less than three years.

The survey was disseminated online via email list of the South African dental association (SADA) and scientific societies (SA society for Periodontics, Implantology & Oral Medicine, and SA society of Maxillofacial & Oral Surgeons). Also, the online survey was provided by email or personal interviews (where was applicable) to academics in various related departments at SA dental faculties, and practitioners who participated in several conferences held in SA (including the ITI implant Congress (Cape Town, SA, July 2019) and the SADA congress (held in Durban, SA, September 2019)). A hard-copy format of the survey was offered upon request from the participant. The interviewers (where applicable) were trained and calibrated to the format and questions of the questionnaire, and, if necessary, answers to any inquiries, were provided without impacting the participant's choices. Descriptive statistics were used to describe the collected survey data.

## RESULTS

142 dental clinicians participated in the survey (Table 1) with the majority of them practising in the Western Cape province (Chart 1; this excluded 47 surveyees where their practice location was failed to be captured).

Sixty-three participants (44%) were general dentists with implant experience (3 years min.), followed by 28 periodontists (20%), 16 registrars (11%), 15 maxillofacial surgeons (11%), 12 prosthodontists (8%), and 8 maxillofacial radiologists (6%), (Chart 2).

Panoramic radiograph accompanied by CBCT examination were the most selected imaging modalities (39%) during the implant planning phase (in all anatomical regions in the jaws). This was followed by CBCT as a single examination (29%), periapical radiograph (PA) with CBCT (19%), PAN + PA (8%), PAN only (2%), other (2%), and PA only (1%). Table II and Chart 3 (A-E) shows in detail the imaging modalities preferred for each questioned anatomical site. In general, "Three-dimensional modalities provide more anatomical information necessary for the success of the therapy" followed by "Better dimensional

**Table 1.** Number of participants from different survey dissemination platform used.

Survey dissemination channel /platform	Number of surveyees
• Conferences and academic meetings	40
• Online channels (e.g., mailing lists)	71
• Academic institutions (interviews and online)	31
• Total number of participants	142

**Table II.** Participants' radiographic preferences during implant planning phase in various anatomical regions (Reprinted from Beshtawi 2021)<sup>25</sup>

Modality	Region 1	Region 2	Region 3	Region 4	Region 5
PA only	0	2	0	0	1
PAN only	4	4	4	2	2
PAN + PA only	10	10	12	14	10
PA + CBCT	26	40	29	14	28
Pan + CBCT	60	46	56	69	48
CBCT only	39	38	38	40	50
No Radiographs	0	1	0	0	0
Other modalities	3	1	3	3	3

- Region 1: Posterior mandible (Unilateral, distal to first premolar region)
- Region 2: Anterior region of the Maxilla/Mandible (Canine to Canine region)
- Region 3: Posterior maxilla region (Unilateral: distal to the first premolar)
- Region 4: One jaw (Mandible/Maxilla) or both jaws (Full mouth)
- Region 5: Mental foramen region (Uni/bilateral).
- PA: Periapical radiograph, PAN: Panoramic radiograph, CBCT: Cone beam computed tomography.

accuracy (if three-dimensional modalities, e.g., CBCT, were selected previously)", and followed by broad coverage of the anatomical region were the most chosen factors to influence the prescriptions of radiographic techniques during the implant planning phase (Table III and Chart 4).

During and directly after surgery (Table IV and Chart 5 A&B), periapical radiography (ASE) was the most selected modality (87% and 65%, respectively). During follow-up (Table V and Chart 6) of asymptomatic patients, PA (ASE) was also the most selected by 46%; Nonetheless, in the presence of postoperative complications, CBCT (ASE) was mostly preferred (32%). The CBCT was preferred the most during follow-up of symptomatic patients due to the extra information it provides regardless of any radiographic artefacts that could occur (caused by implants). Besides, the participants also claimed that broad coverage, availability and ease of access are factors that influence the imaging modality of choice during the follow-up phase (Table VI).

The majority of surveyees (56%) indicated that radiographic follow-up frequency (i.e., after the delivery of the prosthesis) was "After the first 6 months, 12 months, and then every year for a 10-year period" (Chart 7).

Comparisons between the level of formal training and the most frequently selected radiographic examination during various treatment phases, along with the motivating factors for their choice, were noted (Tables VII-IX).

## DISCUSSION

It is evident from the results of this survey, that panoramic radiographs and CBCT were the most preferred combination for implant planning purposes among South African dentists. The CBCT modality was predominantly selected as a single examination or in combination with other modalities during the planning phase with an average of 91% of selections. Nevertheless, a variation of the preferred modalities depending on the anatomical region of the implant site was noted. Minor variations in the preferred radiographic examination were found between various dental speciali-

**Table III.** Participants' indicated factors that impact the radiographic modality choice in planning phase (Reprinted from Beshtawi 2021)<sup>25</sup>.

Factors (Multiple answers were allowed):	Participants (n= 142)
Lower costs for the patients (if the conventional modalities PAN and/or PA were preferred previously)	12
Availability and ease of access of the radiographic modality (if the conventional modalities PAN and/or PA were preferred previously)	18
Radiation dose concerns of three-dimensional modalities (if the conventional modalities PAN and/or PA were preferred previously)	7
Broad coverage of the designated anatomical area (If PAN and/or CBCT were preferred previously)	71
Better dimensional accuracy (if three-dimensional modalities, e.g., CBCT, were selected previously)	87
Three-dimensional modalities provide more anatomical information necessary for the success of the therapy	110
Only three-dimensional modalities (e.g., CBCT), if guided implant surgery is considered	29
Other reasons	5

**Table VI.** Participants' indicated factors that impact the radiographic modality choice during follow-up phase (Reprinted from Beshtawi 2021)<sup>25</sup>

Factors (Multiple answers were allowed):	Participants (n= 142)
Conventional radiographs (especially PA) are preferred, as the CBCT is of limited value if radiographic artefacts (caused by implants e.g., beam hardening and scattering) are evident in the volume.	37
CBCT provides more information regardless of the limitations of possible beam radiographic artefacts caused by the implants	67
Availability and ease of access of the radiographic modality	37
Broad coverage of the designated anatomical area	40
Other reasons	8
Three-dimensional modalities provide more anatomical information necessary for the success of the therapy	110
Only three-dimensional modalities (e.g., CBCT), if guided implant surgery is considered	29
Other reasons	5

**Table IV.** Participants' radiographic preferences during and directly after the surgery (Reprinted from Beshtawi 2021)<sup>25</sup>.

Modality	During the implant surgery	Directly after the implant surgery
Periapical radiograph	123	92
Panoramic radiograph	2	26
CBCT only	7	18
No radiographs	10	6

**Table V.** Participants' radiographic preferences during the follow-up of symptomatic and asymptomatic patients (Reprinted from Beshtawi 2021)<sup>25</sup>.

Modality	Asymptomatic	Symptomatic
Periapical radiograph/s (PA) only	66	11
Panoramic radiograph (PAN) only	20	5
PAN + PA only	25	21
PA + CBCT	1	37
Pan + CBCT	8	17
CBCT only	12	46
No Radiographs	6	0
Others	4	5

ties, therapy phases, and the anatomical regions of interest. CBCT (ASE) was predominantly favoured by OMFS and periodontists during implant planning in all anatomical regions investigated. On the contrary, prosthodontists and registrars predominantly preferred panoramic radiographs combined with CBCT. Both CBCT (ASE) and with combination with panoramic radiographs were selected by the majority of OMFR; while general practitioners pre-

ferred CBCT either with panoramic radiographs or PA (only in one anatomic region investigated). During and immediately after the surgical phase, the majority of all participants preferred periapical radiographs (ASE).

During the follow-up of asymptomatic patients, PA only was preferred by periodontists, GP, registrars, and OMFR, while most prosthodontists and OMFS preferred PAN (ASE). However, during the follow-up of symptomatic patients, the prosthodontists, OMFS, OMFR, and registrars concurred on CBCT (ASE), while most GPs favoured a combination of PA and CBCT examinations. Moreover, PA and CBCT volumes and CBCT (ASE) were preferred by periodontists (39%, 39%, respectively) during the follow-up of symptomatic patients.

Fifty-six percent of participants indicated a follow-up frequency to be after 6, 12 months and annually afterwards for ten years.

Three-dimensional volumes were claimed to allow proper examination during the planning phase by providing extra anatomical details that are vital for the treatment success and, at the same time, advocating better dimensional accuracy. Moreover, broad coverage provided by a given imaging modality was a non-negligible factor; while cost-related factors and radiation dose concerns were the least to affect their radiographic choices. On the other hand, 47% of participants advocated the useful use of CBCT regardless of any possible radiographic artefacts (e.g., beam hardening, caused by the implant body) during the assessment of symptomatic patients.

**Table VII.** Most preferable radiographic examinations by various dental GPs and specialists during planning phase (Reprinted from Beshtawi 2021)<sup>25</sup>.

Region		GP (63)	Periodontists (28)	Prosthodontists (12)	OMFS (15)	OMFR (8)	Registrars (16)	
Planning phase	Region 1	Overall	PAN +CBCT (43%)	CBCT (43%)	PAN +CBCT (59%)	CBCT (46%)	PAN +CBCT (56%)	
		% CBCT*	51 (80.95%)	27 (96.42%)	10 (83.33%)	14 (93.33%)	8 (100%)	15 (93.75%)
	Region 2	Overall	PA+CBCT (35%)	CBCT (50%)	PAN +CBCT (67%)	CBCT (53%)	CBCT (38%)	PAN +CBCT (50%)
		% CBCT*	50 (79.36%)	26 (92.85%)	10 (83.33%)	14 (93.33%)	8 (100%)	16 (100%)
	Region 3	Overall	PAN+CBCT (35%)	CBCT (39%)	PAN +CBCT (67%)	CBCT (60%)	PAN +CBCT (50%)	PAN +CBCT (63%)
		% CBCT*	49 (77.77%)	27 (96.42%)	10 (83.33%)	14 (93.33%)	8 (100%)	15 (93.75%)
	Region 4	Overall	PAN+CBCT (52%)	CBCT (53%)	PAN +CBCT (67%)	CBCT (53%)	PAN +CBCT (62%)	PAN +CBCT (62%)
		% CBCT*	51 (80.95%)	26 (92.85%)	9 (75%)	14 (93.33%)	8 (100%)	15 (93.75%)
	Region 5	Overall	PAN+CBCT (36%)	CBCT (57%)	PAN +CBCT (50%)	CBCT (67%)	PAN+CBCT & CBCT only (50%)	PAN +CBCT (50%)
		% CBCT*	52 (82.53%)	26 (92.85%)	11 (91.66%)	14 (93.33%)	8 (100%)	15 (93.75%)

- Percentage of selections included CBCT (as a single examination or combined with other techniques)
- Region 1: Posterior mandible (Unilateral, distal to first premolar region)
- Region 2: Anterior region of the Maxilla/Mandible (Canine to Canine region)
- Region 3: Posterior maxilla region (Unilateral: distal to the first premolar)
- Region 4: One jaw (Mandible/Maxilla) or both jaws (Full mouth)
- Region 5: Mental foramen region (Uni/bilateral).
- GP: General practitioners. OMFS, OMFR: Oral and Maxillofacial Surgeons and radiologists, respectively.



**Table VIII.** Most preferable radiographic examinations by various dental GPs and specialists during surgical and follow-up phases (Reprinted from Beshtawi 2021)<sup>25</sup>

Phase		GP (63)	Periodontists (28)	Prosthodontists (12)	OMFS (15)	OMFR (8)	Registrars (16)
During the surgery	Overall	PA (90%)	PA (96%)	PA (83%)	PA (67%)	PA (75%)	PA (81%)
	% CBCT*	3 (4.76%)	1 (3.57%)	0	1 (6.66%)	1 (12.5%)	1 (6.25%)
Directly after the surgery	Overall	PA (70%)	PA (64%)	PA (50%)	PA (40%)	PA (62%)	PA (81%)
	% CBCT*	8 (12.69%)	6 (21.42%)	0	2 (13.33%)	2 (25%)	0
Follow-up (Asymptomatic patient)	Overall	PA (59%)	PA (50%)	PAN (25%)	PAN (53%)	PA (62%)	PA (44%)
	% CBCT*	8 (12.69%)	3 (10.71%)	2 (16.66%)	2 (13.33%)	1 (12.5%)	5 (31.25%)
Follow-up (symptomatic patient)	Overall	PA + CBCT (32%)	PA + CBCT and CBCT only (39%)	CBCT (41%)	CBCT (40%)	CBCT (43%)	CBCT (50%)
	% CBCT*	38 (60.31%)	23 (82.14%)	9 (75%)	10 (66.66%)	6 (75%)	14 (87.5%)

\* Percentage of selections included CBCT (as a single examination or combined with other techniques)

**Table IX.** Number of GPs and specialists versus the indicated motivating factor of to select a certain radiographic modality during planning phase (Reprinted from Beshtawi 2021)<sup>25</sup>

Motivating factor	GP (% of 63)	Periodontists (% of 28)	Prosthodontists (% of 12)	OMFS (% of 15)	OMFR (% of 8)	Registrars (% of 16)
Lower costs for the patients (if the conventional modalities PAN and/or PA were preferred previously)	10 (15.9%)	0 (0%)	1 (8.3%)	0 (0%)	0 (0%)	0 (0%)
Availability and ease of access of the radiographic modality (if the conventional modalities PAN and/or PA were preferred previously)	15 (23.8%)	0 (0%)	0 (0%)	2 (13.3%)	0 (0%)	2 (12.5%)
Radiation dose concerns of three-dimensional modalities (if the conventional modalities PAN and/or PA were preferred previously)	2 (3.2%)	2 (7.1%)	0 (0%)	1 (6.7%)	1 (12.5%)	1 (6.25%)
Broad coverage of the designated anatomical area (if PAN and/or CBCT were preferred previously)	29 (46%)	12 (42.9%)	7 (58.3%)	7 (46.7%)	6 (75%)	8 (50%)
Better dimensional accuracy (if three-dimensional modalities, e.g., CBCT, were selected previously)	37 (58.7%)	13 (46.4%)	10 (83.3%)	11 (73.3%)	7 (87.5%)	8 (50%)
Three-dimensional modalities provide more anatomical information necessary for the success of the therapy	41 (65.1%)	24 (85.7%)	10 (83.3%)	13 (86.7%)	6 (75%)	14 (87.5%)
Only three-dimensional modalities (e.g., CBCT) if guided implant surgery is considered	11 (17.5%)	4 (14.3%)	1 (8.3%)	5 (33.3%)	5 (62.5%)	2 (12.5%)
Other reasons	3 (4.8%)	0 (0%)	1 (8.3%)	1 (6.7%)	0 (0%)	0 (0%)

• Multiple answers were allowed.

**Chart 1. Participants' provinces of practice.**

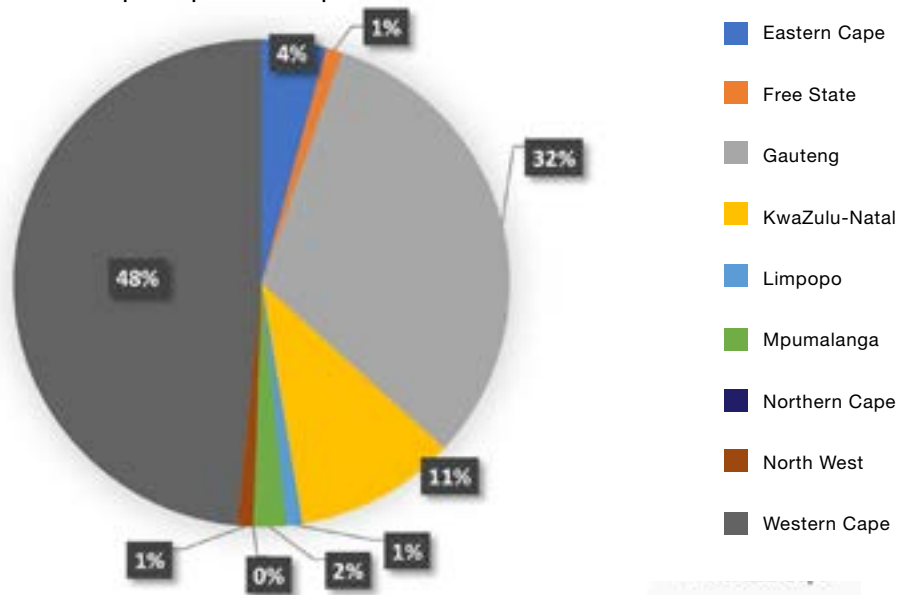


Chart 2. Distribution of the formal training of the sur

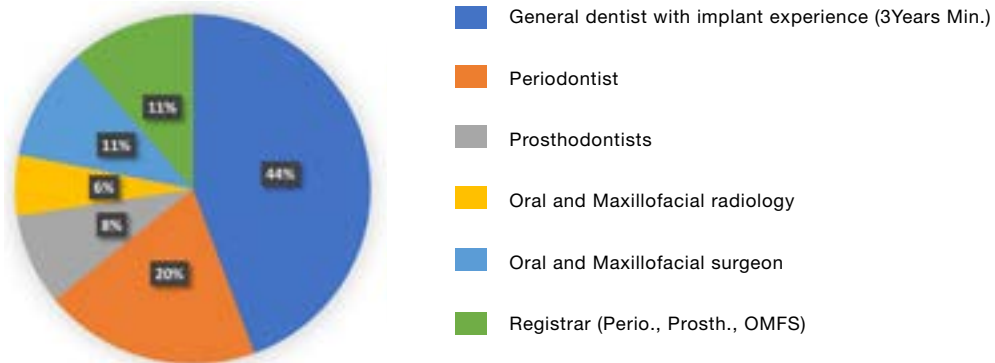


Chart 3. Distribution of the preferred radiographic modalities during planning phase (A-E).

Chart 3A: Posterior mandible (Unilateral, distal to first premolar region)

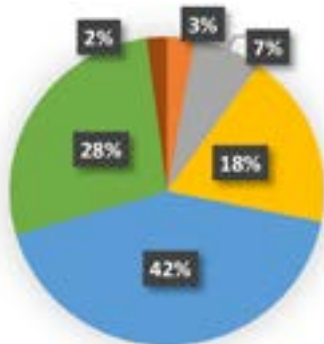


Chart 3B: Anterior region of the maxilla/mandible (Canine to Canine region)

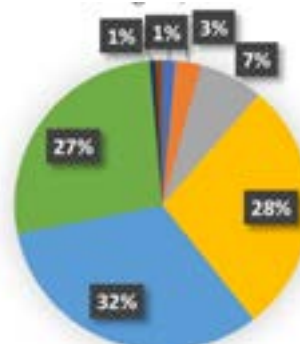


Chart 3C: Posterior maxilla region (Unilateral: distal to the first premolar)

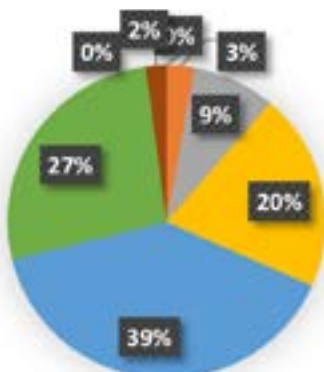


Chart 3D: One jaw (Mandible/Maxilla) or both jaws (Full mouth)

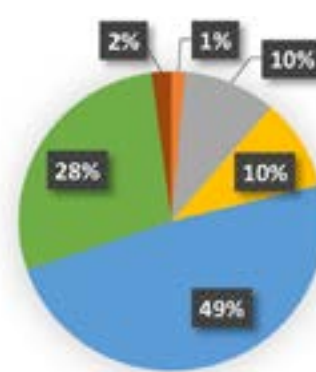
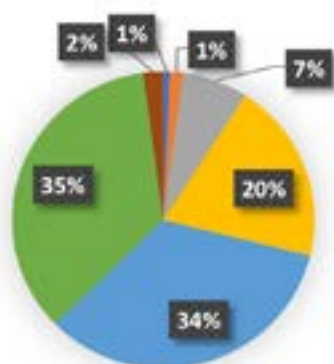


Chart 3E: Mental foramen region (Uni/bilateral)



- Periapical radiograph/s (P.A) only
- Panoramic radiograph (PAN) only
- PAN + P.A only
- P.A + CBCT
- PAN + CBCT
- CBCT only
- No Radiographs
- Others

Chart 4. Indicated factors impacting the radiographic preference during implant planning phase.

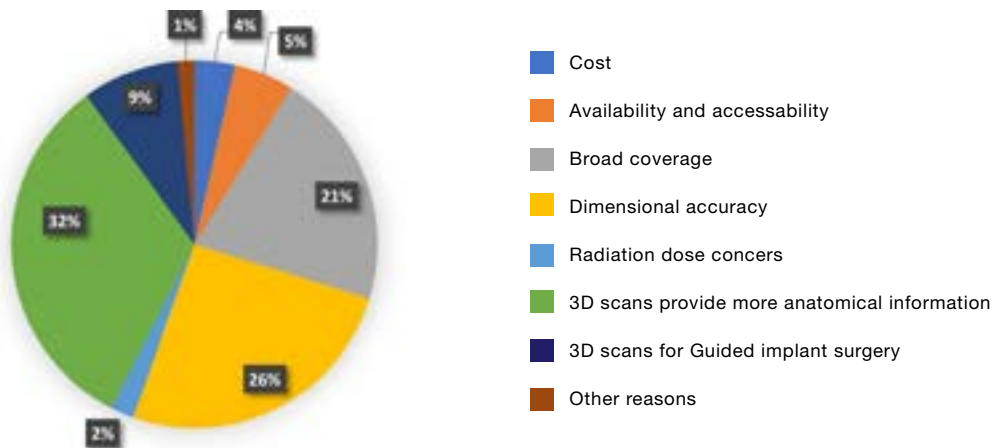


Chart 5. Radiographic modalities preference during and directly after surgery (A&B).

Chart 5A: During the surgery

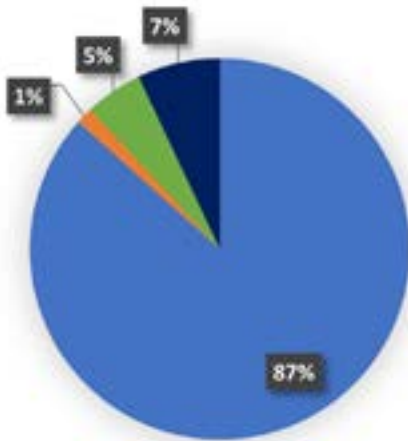


Chart 5B: Directly after the surgery

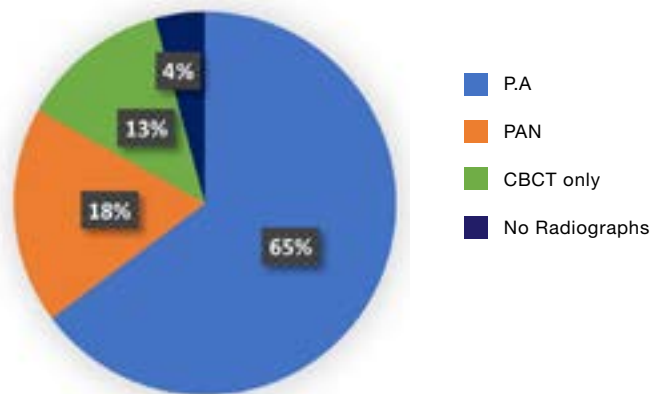


Chart 6. Radiographic modalities preference during the follow-up of asymptomatic and symptomatic patients (A&B).

Chart 6A: Follow-up (Asymptomatic patient)

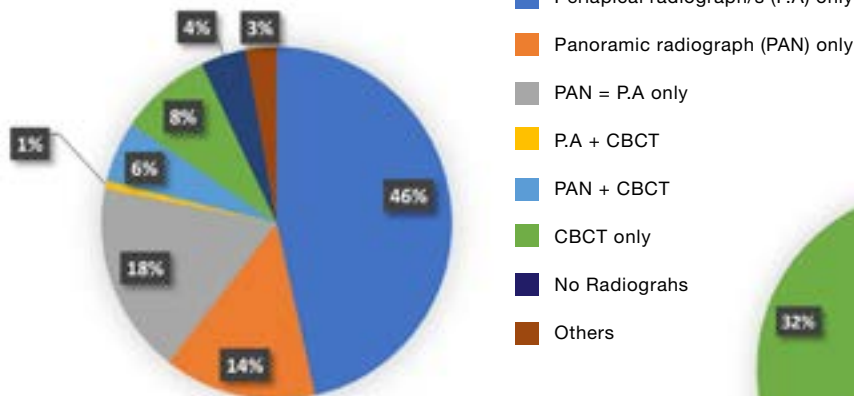


Chart 6B: Follow-up (Symptomatic patient)

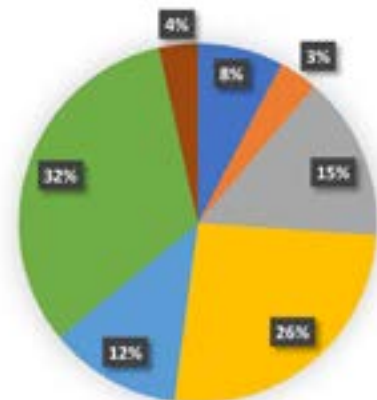
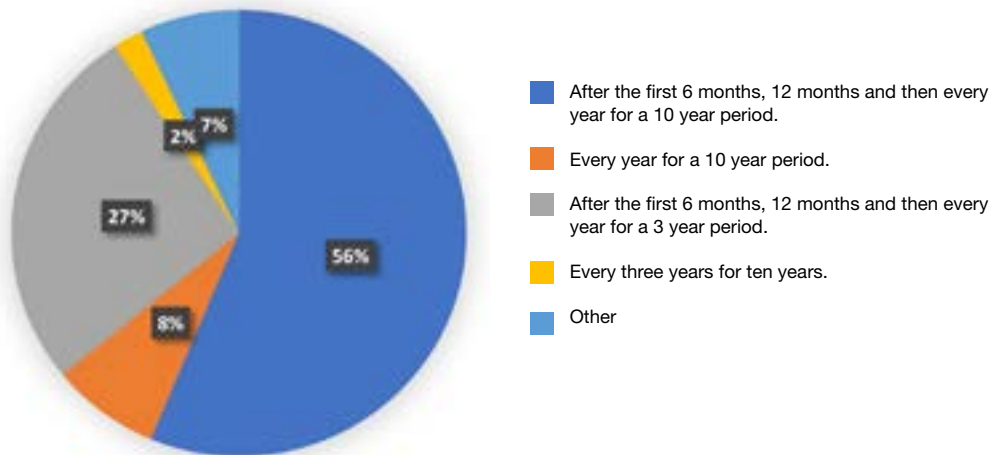




Chart 7. Frequency of radiographic follow-up (after the delivery of the prosthesis).



Panoramic radiographs (ASE) were shown to be the most popular technique during the planning phase in India<sup>15–18</sup> due to mainly the availability and broad coverage factors. Panoramic radiographs (ASE) were also found the most popular during the planning phase in surveys conducted in Brazil<sup>19</sup>, Palestine<sup>20</sup>, and Libya<sup>21</sup>. In Saudi Arabia<sup>22</sup>, 20.2% (the highest percentage) preferred PAN, PA, and CT during the pre-operative phase. In Turkey<sup>23</sup>, CBCT prescriptions were mostly indicated for implant planning. In Italy<sup>24</sup>, 84% of participants in a survey indicated the use of intraoral periapical radiographs, 8.8% preferred panoramic radiographs, and 6.9% preferred CBCT during the follow-up phase.

Inconsistency related to radiographical prescriptions for implant planning at the international level was mentioned<sup>13</sup> for being independent of social wealth and the level of “dental health”.

#### *In the light of international guidelines*

The AAOMR<sup>2</sup> advised in 2012 that “cross-sectional imaging be used for the assessment of all dental implant sites and that CBCT is the imaging method of choice for gaining this information”. On the other hand, the E.A.O guidelines<sup>9</sup> published in 2012 stated that in case of the presence of adequate bone width after clinical evaluation, along with sufficient bone height and clear demarcation of the anatomical boundaries observed on conventional radiographs, then there is no need for further imaging.

Nevertheless, E.A.O mentioned the advantages of cross-sectional imaging e.g., better anatomical structure demarcation, promoting the prosthetic outcomes, assessment of bone defects, in case of bone augmentation, special techniques (e.g., zygomatic implants), and during computer-guided implantology. The ICOI<sup>11</sup> advised the use of CBCT must be justified on an individual basis and after a full clinical assessment. Nevertheless, “... it is virtually impossible to predict which treatment cases would not benefit from having this additional information before obtaining it”<sup>11</sup>.

The findings of this investigation aimed at enriching the pool of evidence in South Africa with regards to the local imaging practices. Such type of evidence would help the decision-makers at local radiation regulatory authorities to

formulate imaging guidelines that adapt/harmonize with the needs of the clinicians and the local working environment.

## CONCLUSION

The majority of the surveyed South African dentists preferred the combination of panoramic radiographs and CBCT volumes for the implant planning phase, while the vast majority concur on the use of periapical radiographs (ASE) during and immediately after surgery. Periapical radiographs were also mostly chosen during the follow-up of asymptomatic patients and, by contrast, CBCT for those who appear with symptoms. The surveyed clinicians believe that CBCT provides extra anatomical information that is dimensionally more accurate.

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# Detrimental orofacial manifestations of dengue and dengue hemorrhagic fever- clinical case series, review of the causes, complications, and vaccine strategies

SADJ September 2021, Vol. 76 No. 8 p457 - p464

SR Dutta<sup>1</sup>, P Singh<sup>2</sup>

## ABSTRACT

### Introduction

It is estimated that there are about 10% of cases that involve oral mucosa in patients with dengue hemorrhagic fever (HF), and even less number of cases in dengue fever (DF) has been reported. This leads to a lack of future investigation.

### Aims and objectives

This review intends to enhance the understanding of the epidemiology, clinical features involving the oral manifestations, and treatment of dengue disease.

### Design and Methods

Several search engines, including PubMed, World Health Organization (WHO), and Pan American Health Organization (PAHO) websites were utilized for the literature search using the terms dengue and dengue shock syndrome.

### Results

Dengue is a major arthropod-borne viral disease of humans. Its presentation is protean and varies from an undifferentiated viral syndrome to viral HF and severe shock. The early diagnosis of the oral manifestations, hemorrhagic, or mucocutaneous, may lead to timely clinical evaluation of the patient with signs and symptoms suggestive of dengue viral infection.

### Conclusion

The specific therapy for dengue infections is still undiscovered. Proper care, including vector control and prevention of mosquito bites, may be beneficial. However,

the role of dental professionals and general practitioners is important in identifying the oral manifestations of dengue viral infection and providing specific diagnosis and effective treatment to the patients.

### Keywords

Dengue, dengue hemorrhagic fever, oral manifestations, dengue vaccines

## INTRODUCTION

Dengue disease is an acute disease caused by four closely related serotypes of dengue virus from the Flaviviridae family, namely DENV-1, DENV-2, DENV-3, and DENV-4. The four variants are indistinguishable clinically. The viruses are composed of one strand of ribonucleic acid (RNA), which is within the same genus, thanks to the yellow jack and West Nile viruses. Dengue disease is the foremost prevalent mosquito-borne viral disease in humans, occurring in tropical and subtropical countries of the globe where over 2.5 billion people are in peril of infection.<sup>1</sup> The World Health Organization (WHO) has estimated 50 million cases of dengue and the spread of another hundred thousands of cases of dengue viral hemorrhagic fevers (VHF) occurring annually, that stimulate the epidemic activity.<sup>2</sup> It is estimated that about 1.8 billion people die from dengue in the WHO member states of Western Pacific and South-East Asia.<sup>3</sup> Therefore, the early diagnosis of the dengue virus infection in the febrile stage is critical for appropriate management. The availability of scientific literature that reports on the oral manifestations of dengue fever (DF) are scanty as the signs and symptoms of the affected patients usually get unnoticed or misinterpreted with other conditions, most likely leukemia, hemophilia, thrombocytopenia by the dental professionals. WHO included gingival bleeding, a common oral manifestation of DF as the nonspecific finding of the disease.<sup>4</sup> This review focuses on the identification of the predictive markers of oral and clinical findings within the acute stage of dengue infection. Dengue VHF (DHF) was first documented in 1953 in Manila, the Philippines.<sup>5</sup> In humans, the manifestations of dengue infection vary from relatively mild, nonspecific viral syndrome mentioned as DF to severe hemorrhagic disease and death. The severe hemorrhagic like disease known as DHF and

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### Author contributions:

1. **Dr. Shubha Ranjan Dutta:** Collection of data (case reports), analysis of the data, drafting of the manuscript
2. **Dr. Purnima Singh:** Analysis of the data, its organization, drafting the manuscript, and revising the manuscript



dengue shock syndrome (DSS), is the usual explanation for hospitalization and death among children in Asia.<sup>6</sup>

### Epidemiology

About 500,000 to 1,000,000 individuals' worldwide contract DF/ DHF annually, making it the foremost common arthropod-borne disease on earth.<sup>7</sup> WHO also has an internet-based system for global surveillance of DF/ DHF known as DengueNet to monitor and guide dengue/DHF prevention and control programs.

### Pathophysiology and Oral Manifestations

The life-span of DF within the mosquito is 8-12 days followed by a further 3-14 days within the human host. This is often followed by clinical disease lasting 3-7 days. The virus is passed from mature female mosquitoes to their offspring, and an infected mosquito is infectious throughout its lifespan. The amount of clinical dengue infection ranges from asymptomatic infection to critically ill patients with hemorrhage and shock. Case definitions are described in TABLE I.

Individuals with DSS develop antibodies and lifelong immunity to the variant that they contracted and a transient immunity to all or any four of the variants. Only after a second, third, or fourth infection (i.e., with a special variant) is contracted, is it likely to develop a clinical case of hemorrhagic disease. Transplacental transfer of maternal antibodies can put an infant in peril for DHF.<sup>8</sup>

The oral cavity is considered the gateway and the site of manifestation of a wide range of systemic diseases. Therefore, the identification of oral manifestations of dengue becomes of utmost necessity to establish the early diagnosis of this pathology. Oral manifestations are commonly associated with DHF, and infrequently in cases of classic DF. These include vesicles on the lips and palate, lip crustings, and blisters in different areas of the mouth, gingival bleeding, erythema, oral candidiasis, osteonecrosis of the dentoalveolar structure, lingual hematoma, osteonecrosis of the jaw, and difficulty in swallowing.<sup>9,10</sup> In such a scenario the role of dental professionals, especially general practitioners, becomes most important to identify these problems and guide the patient for effective medical care and treatment.

The general pathologic findings<sup>11</sup> include:

- Depression of megakaryocytes and other hemopoietic cells within the bone marrow.
- Active proliferation of lymph nodes and spleen, and lymphocytolysis in germinal centers.
- Focal mid-zonal necrosis and fatty changes within the liver.

- Occasional glomerulonephritis (due to immune complex deposition).

### Case Presentations

A few clinical case reports obtained from patients visiting the out-patient department (OPD) clinic in our Institution are presented below to address, in a specific way, oral manifestations associated with or related to DF. These reports are presented after written consents were obtained from the patients.

### CASE REPORT 1

A moderately aged male patient (~55-65 years, not accurately determined by the patient) visited the hospital for an ulcer in his mouth, pain-free gum bleeding, and trouble in gulping. He additionally gave a history of fever for several weeks and body temperature ranging between 110°F and 120°F. Ulcers at first had begun in the right mandibular posterior buccal mucosa and afterward included the junction of hard and soft palate [Figure 1A], tongue [Figure 1B]. He also had several tiny red spots on his face [Figure 1C] for more than one month. History uncovered that he had joint pain from the past few days with a history of fever. On clinical assessment, petechiae were observed in the upper face and neck. He had an axillary temperature of about 125°F. Respective submandibular lymphadenopathy was obvious. The intraoral assessment revealed raised hemorrhagic plaques on the right posterior buccal mucosa just as on the dorsum of the tongue and floor of the mouth [Figure 1D]. The hemorrhagic plaques were encircled by the erosive mucosa, and the outside of the hemorrhagic plaques was sporadic. At the intersection of the hard and soft palate, a diffuse erosion of 4 × 4 cm was available. The tonsils on both right and left sides were extended, erythematous and aggravated. The patient had xerostomia and the tongue had all being coated with plaques. A tourniquet test was performed and around 10-15 petechiae/2.5 cm<sup>2</sup> were observed. The patient was then exposed to a progression of hematological and biochemical examinations. Platelet count was 45000 cells/mm<sup>3</sup>, absolute leukocyte counts 3500 cells/mm<sup>3</sup>, serum albumin 2.8 g/dl, hemoglobin 9 gm/dl, and ESR 49mm/hr., INR> 1.5, Bleeding time 8 minutes were noted.

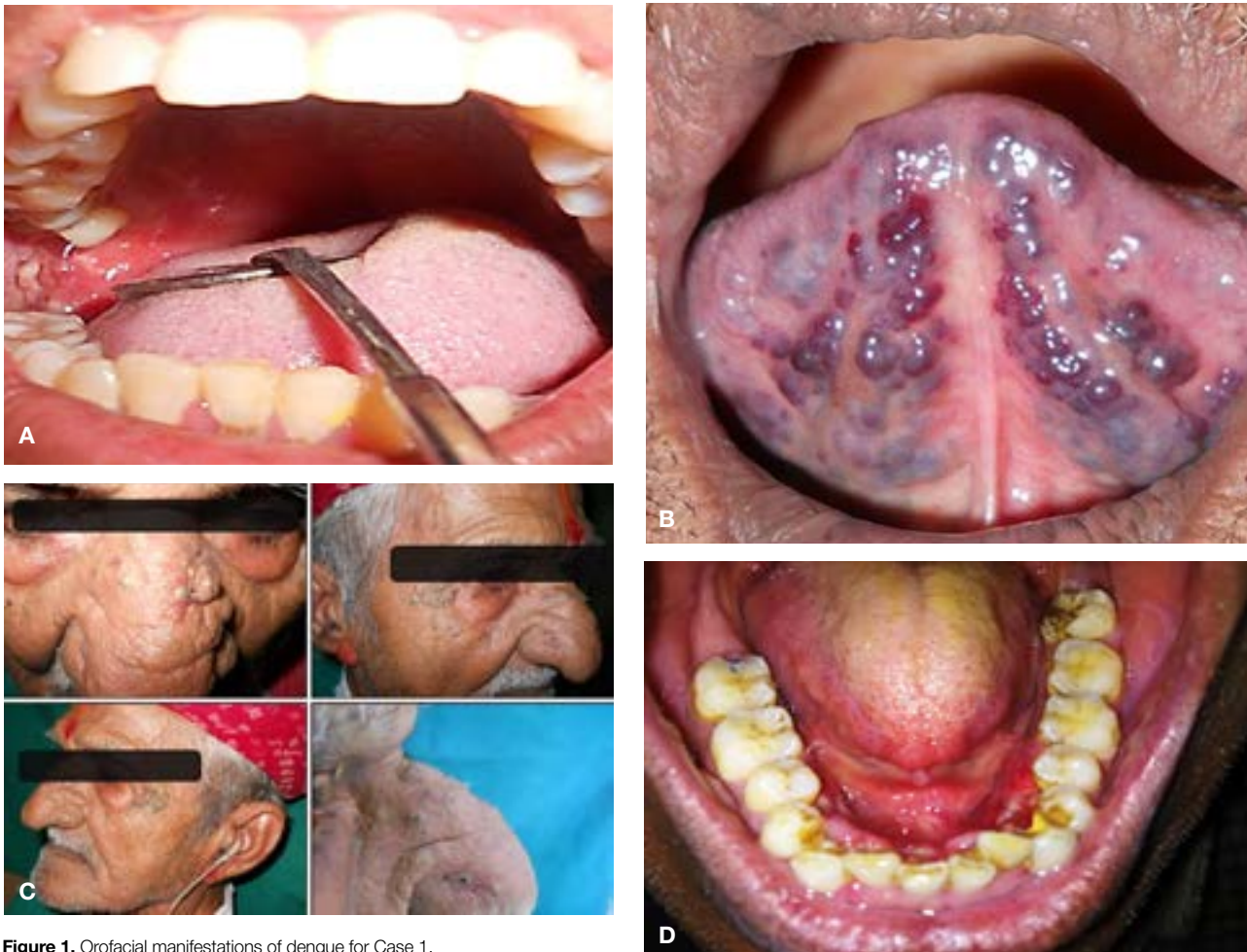
With the above outcomes, a temporary determination of DHF was made. To confirm further, immunoglobulin M (IgM) was identified by an immunizer catch protein connected enzyme-linked immunosorbent assay (ELISA; 7 days after the beginning of indications).

### CASE REPORT 2

A 49 year old female patient visited the clinic for a painless therapy of blister in her mouth, bleeding from the gums and

TABLE I: Case definitions

	Type	Primary symptom	Secondary symptom
A.	Asymptomatic or mild infection	Very common and few or no symptoms besides fever	
B.	DF	Fever and two or more of the secondary symptoms	Retro orbital/ocular pain, headache, rash, myalgia, arthralgia, leukopenia, hemorrhagic symptoms that do not meet the definition of DHF
C.	DHF	All symptoms of DF plus secondary symptoms	Thrombocytopenia (less than 100,000 cells per microliter of blood), Evidence of plasma leakage manifested by hemoconcentration (increase in hematocrit >20% of normal for age or a decrease < 20% after rehydration) or pleural effusion, ascites, or hypo-proteinemia.
D.	DSS	All symptoms of DHF plus secondary symptoms	Signs of shock, including rapid pulse, narrow pulse pressure and, most importantly, poor organ perfusion



**Figure 1.** Orofacial manifestations of dengue for Case 1.

alveolar mucosa on the left posterior back of the jaw [Figure 2A] for the past one month and she had trouble swallowing for as far back as 15 days. She was accounted for a history of high-grade fever for over a few weeks, stomach pain, and occasional nose and gum bleeding. Rankles at first were present on the left half of maxillary alveolar mucosa followed by its appearance on the upper right mucosa. Bluish-red vessels were observed prominently for 4-5 days in the lower appendages on gripping. There were continuous joint aches from the hour of the beginning of the fever. On clinical assessment, petechiae were observed everywhere on the body including the upper and lower appendages except the palms and soles, lower face, [Figures 2B] and neck. The axillary temperature of 103°F was noted. On palpation, respective submandibular lymphadenopathy was apparent. The intraoral assessment revealed the appearance of common ulcerative and hemorrhagic sores on both sides of the lower jaw, starting from cuspid to molar region. Petechiae were additionally present on the extraoral lower face and intraoral right lower posterior premolar and molar regions. At the intersection of the hard and soft palate and mostly on the hard palate, on both sides, little blood-filled vessels were prominent [Figure 2C]. On the right posterior buccal mucosa strip band of dark blue hemorrhagic band observed [Figure 2D]. A tourniquet test was performed and around 15-30 petechiae/2.5 cm<sup>2</sup> were observed. The patient was then exposed to significant hematological and biochemical examinations to build up the analysis. Thrombocytopenia (45000 cells/mm<sup>3</sup>), absolute leukocyte counts (3300 cells/mm<sup>3</sup>), lymphocyte check (9%), serum albumin (2.9 gm/dl), hemoglobin (10 gm/dl), and ESR (45mm/hr), INR (> 1.5), Bleeding time (9.15 minutes) were recorded. The testing of dengue virus IgM by a capture

ELISA (MAC-ELISA) is very sensitive and can be performed at least five days after the beginning of fever for confirmatory diagnosis.

### CASE REPORT 3

A 25-year-old male patient was reported with painless blood clots on the lower front region (cuspid to cuspid) of the jaws [Figure 3A] and non-healing ulcers on the lower lip [Figure 3B] and right posterior lower back region on the jaw [Figure 3C]. The patient was determined to have DF and presented signs and manifestations related to high fever, muscle pain, and rash. Serologic tests uncovered the immunoglobulins (IgM) and (IgG) for dengue antigens. Under clinical diagnosis, the patient was taking acetaminophen (500 mg) four times each day and oral hydration. White cell count was 2500 cells/mm<sup>3</sup> (out of these of these 1155/mm<sup>3</sup> were neutrophils). Petachiae, bleeding gums, ulcer, dryness of the mouth were the intraoral manifestations. His platelet count was 59,000/mm<sup>3</sup>, prothrombin time > 30 seconds. The intraoral assessment uncovered a few white plaques with ulcerative spot situated on the lower lip mucosa. The patient had a history of headache, orbital pain, hematemesis, and hematochezia. Detecting viral genomic sequences with real-time reverse transcription-polymerase chain reaction (rRT-PCR) or dengue nonstructural protein 1 (NS1) antigen by immunoassay can confirm the presence of dengue in patients with a viable clinical history.

### Clinical spectrum

The presentation of the oral manifestations in the above case reports suggests that a thorough evaluation of the oral findings in cases of dengue infection is extremely important, though such reports in the literature are rare. Therefore, it is up

to the dentists and otorhinolaryngologists to be informed about the various oral manifestations of the disease so that proper diagnosis and treatment can be provided to the patients.

The spectrum of clinical manifestations<sup>12,13</sup> is shown in Figure 4. Many of the infections that occur in children are asymptomatic, while they are mostly symptomatic in adults. The clinical features<sup>12,14</sup> and the laboratory investigation<sup>11,15</sup> for the diagnosis of DHF are enlisted in TABLE II.

### Management

The following steps are necessary for the management of the disease:

1. Hospitalization could be necessary when significant dehydration (>10% of normal body weight) has occurred.

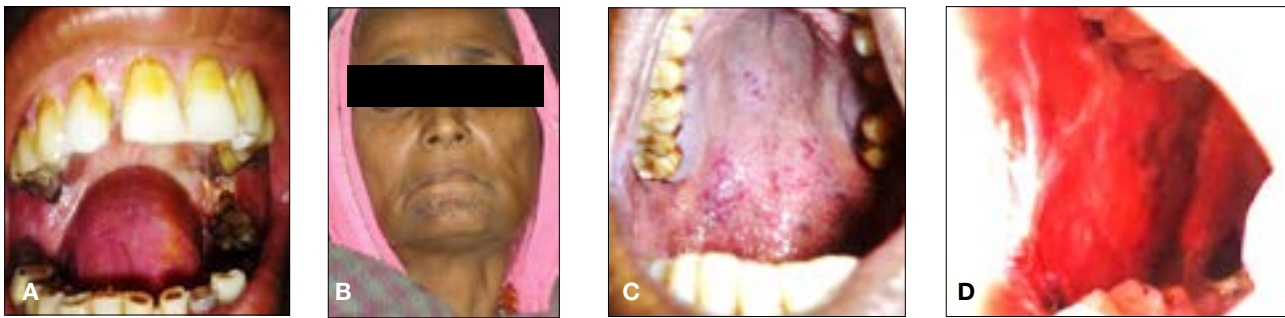
2. Other signs of great dehydration are highlighted.
3. One should avoid NSAIDs/aspirin.
4. Unless it is indicated, blood transfusion/IV fluids should be avoided.
5. Steroids and antibiotics should be avoided.
6. Rapid changes within the speed of fluid infusion should be avoided.
7. The insertion of a nasogastric tube to figure out concealed bleeding or lavage to stop bleeding are not recommended.
8. If present, acidosis should be corrected.

As hemorrhage is the hallmark of dengue, it is warranted that dentists are aware of the complications of performing dental procedures in patients suffering from DF/DHF. It becomes equally important to know the correct medical histo-

**TABLE II: Criteria for diagnosis of DHF**

Clinical features	Laboratory investigations
1. Pyrexia- sudden, often of high grade, lasts for 2-7 days	(A) Virus isolation- The virus should be sought from serum obtained during the febrile phase of the illness.
2. Hemorrhagic manifestations include at least one of the following: <ul style="list-style-type: none"> <li>• Petechiae, purpura, ecchymosis</li> <li>• Epistaxis, gum bleeding, bleeding from the lining mucosa, GIT, or injection site</li> <li>• Hematemesis and/or</li> <li>• A positive tourniquet test: a sphygmomanometer cuff is inflated on the arm to point midway between systolic and diastolic pressures for five minutes. A positive test is alleged when &gt; 20 petechiae appear during a 2.5 cm square (or 3 cm diameter circle) on the skin surface on the forearm. Patients in shock usually test positive if it is performed after recovery from shock. The test could even be negative or only mildly positive (&gt; 10 petechiae/2.5 sq. cm) during the phase of profound shock.</li> </ul>	<p>(B) Serology- Serologic diagnosis is achieved by demonstrating a rise in hemagglutination inhibition, immune reaction, or neutralizing antibody titers inappropriately timed paired sera drawn 7-14 days apart. Samples are collected as follows:</p> <p>S1 (acute serum) – soon after hospitalization  S2 (convalescent serum) – within 10-14 days before being discharged from the hospital  S3 (late convalescent serum) – within 14-21 days after the onset of the disease</p> <p>Hemagglutination inhibition assays:  This is one of the WHO-recommended reference tests for dengue virus infections. The disadvantages of these tests are:</p> <ul style="list-style-type: none"> <li>• Time consuming</li> <li>• Cannot identify specific serotypes</li> <li>• Cross-reaction with other related flaviviruses, e.g., yellow jack, West Nile fever, Japanese encephalitis, etc</li> </ul> <p><b>ELISA</b></p> <p>(i) The IgM antibody – Capture ELISA (MAC-ELISA) is particularly useful in the diagnosis of recent infection. By two days following defervescence, patients with primary or secondary infections have detectable IgM antibodies. However, the antibodies wane rapidly and after 2-3 months, most patients are seronegative. Therefore, tests on one serum sample may indicate a recent infection. However, the IgM antibodies are relatively specific for dengue, and they do not distinguish between the numerous serotypes. The rising titer of IgM antibodies is much more specific.</p> <p>(ii) IgG ELISA has results and interpretations like the hemagglutination inhibition assay.</p> <p><b>Commercial dengue blot assay:</b></p> <p>It is a rapid diagnostic assay, which is as sensitive as hemagglutination inhibition assay in diagnosing a secondary dengue infection but not so just in case of primary infection.</p> <p>Newer diagnostic techniques:</p> <ol style="list-style-type: none"> <li>1. Reverse transcriptase-polymerase chain reaction (RT-PCR): detection of viral RNA</li> <li>2. <b>Hybridization probe:</b> Identification of viral nucleic acids with the assistance of hybridization probes</li> <li>3. <b>Immuno-cytochemical methods:</b> Use of enzyme conjugates, like peroxidases and phosphatases in conjugation with either polyclonal or monoclonal antibodies to detect dengue virus antigen</li> </ol> <p><b>Other associated laboratory findings are:</b></p> <ul style="list-style-type: none"> <li>• WBC count – WBC count could also be normal, but leucopenia is common. Neutrophils decrease towards the top of the febrile phase. A relative lymphocytosis with quite 15% atypical lymphocytes is common at the top of the febrile phase (critical stage) and early shock stage.</li> <li>• Hypoproteinemia</li> <li>• Mildly elevated AST and BUN</li> <li>• Evidence for DIC: Prothrombin time (PT) and activated partial thromboplastin time (aPTT) with decreased serum fibrinogen and increased Fibrin</li> </ul>
3. Hepatomegaly. Formation of degradation products (FDPs). <ul style="list-style-type: none"> <li>• Thrombocytopenia.</li> <li>• Rising hematocrit.</li> <li>• Metabolic acidosis.</li> <li>• Urine mild albuminuria</li> </ul>	





**Figure 2.** Orofacial manifestations of dengue for Case 2.

ry and suggest appropriate treatment. Besides, the nature of the disease should be considered, and care should be taken to prescribe medicines. These patients should avoid the use of non-essential drugs, especially anti-inflammatories, antibiotics, and other drugs that show renal, hepatic, or hematological toxicity.

The signs of recovery, criteria for discharging patients, factors affecting the prognosis of dengue, and the measures for prevention and control of DHF<sup>14</sup> outbreak are described in TABLE III.

#### Current progress in dengue vaccines

The development or trial of several vaccines is underway. This includes live attenuated, live chimeric, and inactivated virus vaccines, as well as live recombinant, DNA, and subunit vaccines.<sup>16</sup> However, there is no licensed dengue vaccine yet. The live attenuated virus vaccines and live chimeric virus vaccines are being evaluated clinically. The opposite vaccine candidates are evaluated in preclinical animal models or are being prepared for clinical trials. For dengue vaccines to be safe and efficient, it is important to consider the immuno-

pathogenic complications like antibody-mediated enhancement and autoimmunity.

**Disease Prevention Programs:** For epidemic prediction, health authorities have to be prepared to accurately monitor dengue virus transmission in a community and provide information at any time point on the site of transmission (Figure 5), virus serotypes causing the infection, and the clinical manifestations that are claimed to be due to dengue infection.<sup>17, 18</sup> Any release of information should be in consultation with infectious-disease physicians. All patients with any hemorrhagic manifestation; on admission diagnosis of viral encephalitis, aseptic meningitis, or meningococcal shock; and/or a fatal outcome following a viral prodrome should be considered.<sup>19</sup> This proactive television is meant to watch disease activity during the inter-epidemic period before epidemic transmission. Individually, the three components are not sensitive enough to supply effective early warning, but when used collectively, they are visiting often accurately predict epidemic activity.<sup>17</sup>

**Mosquito control –** Controlling the mosquito vector, *Aedes aegypti*, in and around the home, where most transmission

**TABLE III:** Signs of recovery, criteria for discharging patients, factors affecting the prognosis of dengue, and the measures for prevention and control of DHF outbreak

Signs of recovery	Criteria for discharging patients	Factors affecting the prognosis of dengue	Measures for prevention and control of DHF outbreak
Stable pulse, sign, and rate of respiration	Absence of fever for a minimum of 24 hr without the use of antipyretics	The presence of enhancing and non-neutralizing antibodies increases the severity	Vector surveillance and control measures, (e.g. residual spraying) should be initiated.
Normal temperature	Return of appetite	Children below the age of 12 years are more susceptible to get DHF/DSS	Community participation should be ensured
No evident external/internal bleeding	Visible clinical improvement	It affects females more than males	Facilities for case management of patients with hemorrhagic shock should be assessed
Return of appetite	Good urine output	It affects Caucasians more than blacks	Health personnel should be alerted to report the increase/clustering of cases
No vomiting.	A recovery period of at least 3 days from shock	Malnutrition is protective	Prevention measures for the control of mosquito bites should be conveyed to the general population: i. Wearing clothes that cover arms and legs ii. Using mosquito nets/repellants iii. Keeping patients shielded from a sting within the acute phase
Good urine output	No respiratory distress and ascites	The sequence of infection: Serotype 1 followed by serotype 2 seems to be more dangerous than serotype 4 followed by serotype 2	Eliminating mosquito-breeding places: i. Emptying water tanks once hebdomadally ii. Covering and sealing septic tanks and soak-away pits iii. Removing rubbish iv. Removing water from coolers and other places where water has remained stagnant
Stable hematocrit	Increased platelet (> 50,000/ per microliter of blood) count	Infecting serotype: Type 2 is more dangerous than the other serotypes	
Convalescent confluent petechial rash			



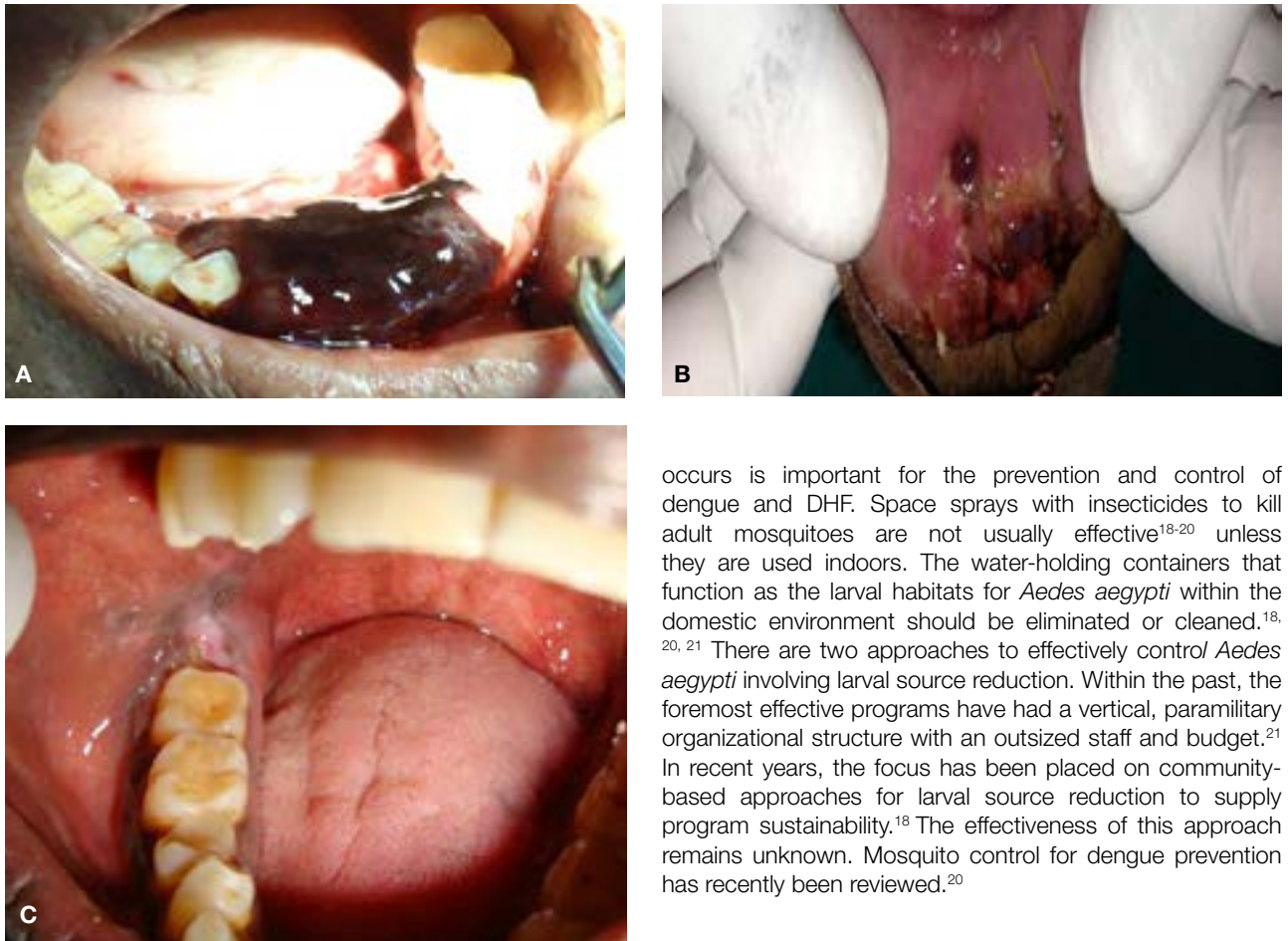


Figure 3. Oral manifestations of dengue for Case 3

occurs is important for the prevention and control of dengue and DHF. Space sprays with insecticides to kill adult mosquitoes are not usually effective<sup>18-20</sup> unless they are used indoors. The water-holding containers that function as the larval habitats for *Aedes aegypti* within the domestic environment should be eliminated or cleaned.<sup>18, 20, 21</sup> There are two approaches to effectively control *Aedes aegypti* involving larval source reduction. Within the past, the foremost effective programs have had a vertical, paramilitary organizational structure with an outsized staff and budget.<sup>21</sup> In recent years, the focus has been placed on community-based approaches for larval source reduction to supply program sustainability.<sup>18</sup> The effectiveness of this approach remains unknown. Mosquito control for dengue prevention has recently been reviewed.<sup>20</sup>

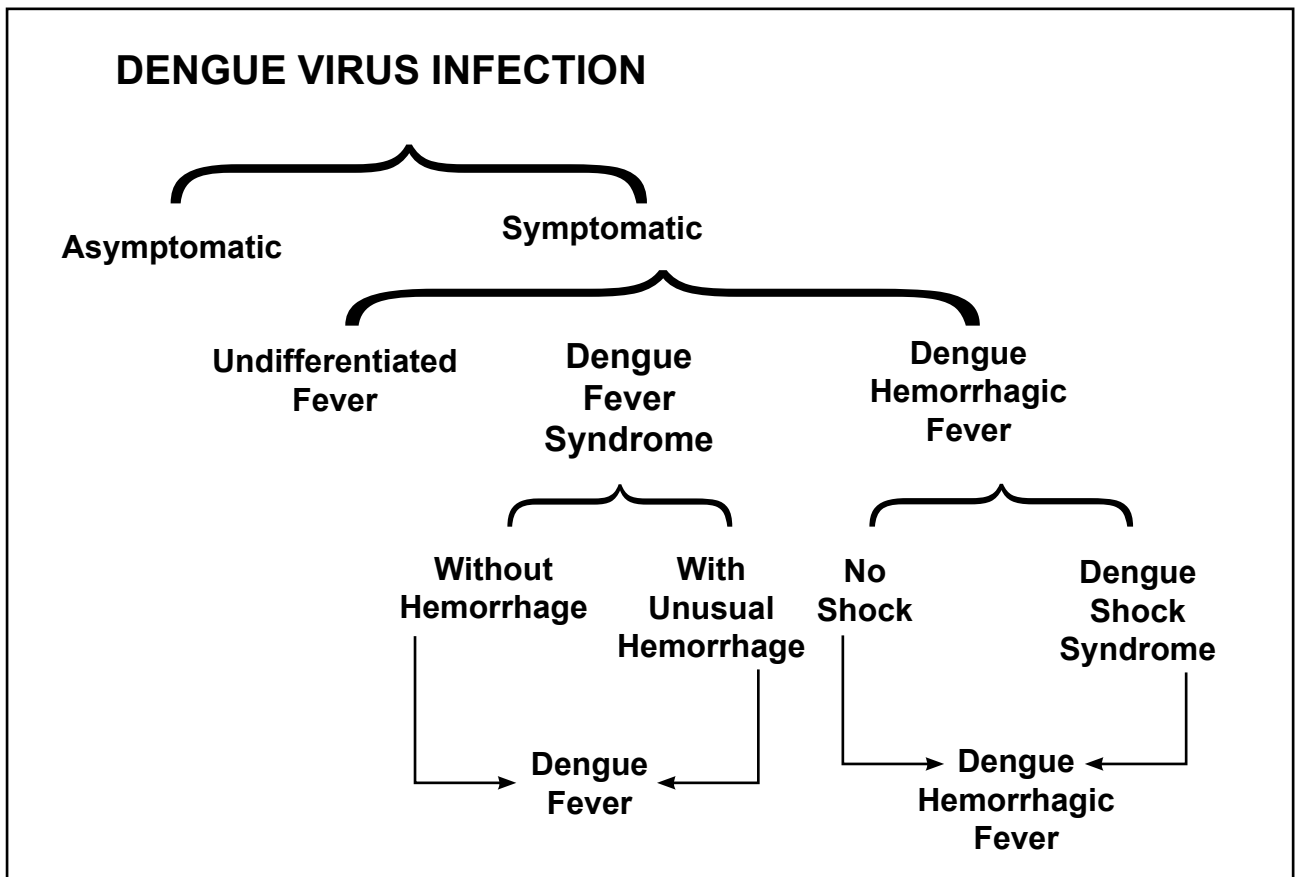
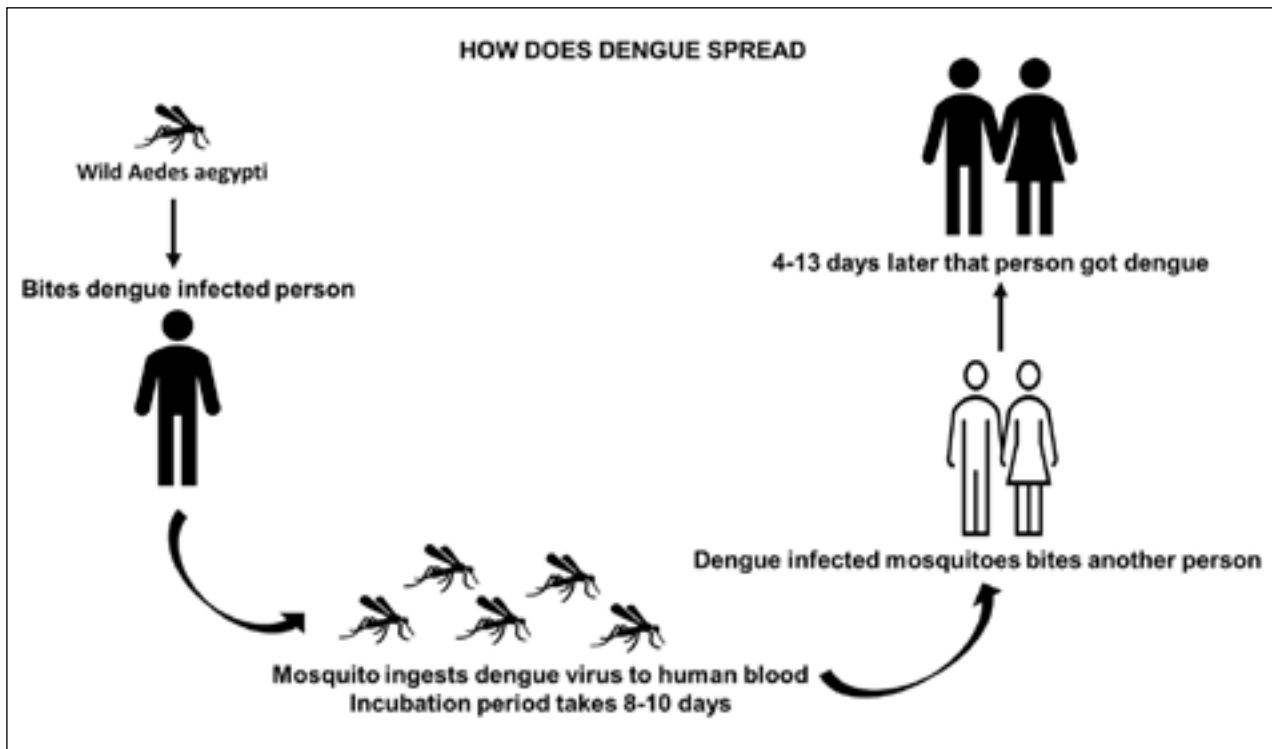


Figure 4: Schematic representation of the spectrum of clinical manifestations of dengue virus infection



**Figure 5:** Schematic representation of the mode of spread of dengue virus

### Conclusion

Dengue is a typical self-limiting disease. However, the lack of proper monitoring and adequate volume replacement may cause a fatal outcome. There is an insight into emerging outbreaks of dengue in various states of India. The oral manifestations regarding DF/ DHF are not commonly reported, hence dental professionals should be made aware of the broad range of alterations during dengue viral infections. This review with case presentation highlights the importance of oral lesions due to DF to clinicians of all fields, especially in dengue epidemic or endemic areas. Therefore, it becomes imperative for dental and medical care physicians to acquire updated knowledge about early diagnosis and management guidelines. Moreover, future research with appropriate methodologies focusing on the oral manifestations of DF/ DHF is required to provide a detailed description of the oral changes in the context of dengue infection.

### Disclosure

Nothing to disclose.

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## Do the CPD questionnaire on page 501

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

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- 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.

# Clinicopathological evaluation of focal reactive lesions of the Gingiva

SADJ September 2021, Vol. 76 No. 8 p465 - p470

C Karuma<sup>1</sup>, S Ngwenya<sup>2</sup>, S Shangase<sup>3</sup>

## ABSTRACT

### Introduction

Focal reactive gingival lesions are elicited by chronic irritation primarily due to dental plaque, calculus, over-hanging dental restorations and ill-fitting dental prosthesis. Persistent irritation of the gingiva can lead to tissue injury and trigger inflammation leading to proliferation of endothelial cells, multi-nucleated giant cells, fibroblasts and tissue mineralisation.

### Aims

The aim and objectives of the study were to determine the relative frequency and distribution of focal reactive gingival lesions according to sex, age, and anatomical site in patients who presented at the Witwatersrand Oral Health Centre.

### Design

Retrospective cross-sectional study

### Methods

Convenience sampling of patient records from the years 2011 to 2017 were analysed from the Department of Oral Pathology and the Department of Oral Medicine and Periodontology at the Witwatersrand Oral Health Centre. Sociodemographic variables and clinical features were evaluated.

### Results

Female patients accounted for 70.8% (n = 172) of all focal reactive gingival lesions, with the majority of the lesions having occurred in the maxilla (56.4%; n = 137). The age of patients ranged from 3 months to 88 years.

### Conclusion

Contrary to findings in other studies, the peripheral ossifying fibroma was the most common focal reactive gingival lesion, after analysing 243 cases.

### Keywords

Focal reactive gingival lesions, pyogenic granuloma, lobular capillary haemangioma. Peripheral ossifying fibroma, focal fibrous hyperplasia and peripheral giant cell granuloma.

### Nomenclature

**FRGL** : Focal reactive gingival lesions  
**LCH** : Lobular capillary haemangioma  
**FFH** : Focal fibrous hyperplasia  
**POF** : Peripheral ossifying fibroma  
**PGCG** : Peripheral giant cell granuloma  
**Rrb** : Rank biserial correlation coefficient  
**DMF** : Decayed, Missing and Filled

## INTRODUCTION

Focal reactive gingival lesions (FRGL) are gingival enlargements elicited by chronic irritation primarily due to over-hanging dental restorations, ill-fitting dental prostheses, plaque and calculus<sup>1</sup>. The gingiva bears the brunt of this chronic irritation and thus is the most common intra-oral site for these lesions<sup>2</sup>. Persistent irritation of the gingiva can lead to tissue injury and trigger inflammation leading to proliferation of endothelial cells, multi-nucleated giant cells, fibroblasts and tissue mineralisation<sup>3</sup>. The proliferation can eventually lead to a localised hyperplasia and an exuberant gingival mass<sup>4</sup>.

Even though FRGL have similar aetiological factors, the various lesions have characteristic histopathological features, and are considered by most authors as separate distinct lesions<sup>5</sup>. FRGL are generally classified into peripheral ossifying fibroma (POF), lobular capillary haemangioma (LCH), peripheral giant cell granuloma (PGCG) and focal fibrous hyperplasia (FFH)<sup>6</sup>. Some authors have postulated that these pathological entities represent one lesion at various histological developmental stages<sup>7</sup>. They argue that a LCH may develop into a POF or FFH with time through further collagen build up and maturation<sup>8</sup>. However, if this hypothesis is true, a definite age grouping for the different histological entities should be apparent.

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2. **Sizakele Pride Ngwenya**: Conceptualisation and design, data analysis and interpretation, first draft, revision, final write-up and approval 30%
3. **Sindisiwe Shangase**: Conceptualisation and design, data analysis and interpretation, first draft, revision, final write-up and approval - 30%



**TABLE I: Socio-demographic and clinical factors**

Variable	LCH (n=80)	POF (n=86)	FFH (n=69)	PGCG (n=8)	Total
<b>Gender</b>					
Male	57	62	48	5	172
Female	23	24	21	3	71
<b>Age (years)</b>					
Range	10- 88	0-72	7-75	13-56	0-88
Mean	35.3	34.7	41.8	28.4	35.1
<b>Lesion size (mm)</b>					
Minimum	6	6	4	6	4
Maximum	52	35	45	35	53
Average	17.53	16.01	14.65	16.63	16.21
<b>Recurrence of lesion</b>					
Recurrence	16(20.0%)	24(27.9%)	12(17.4%)	2(25.0%)	54(22.2%)
Non-recurrence	64	62	57	6	189

The nomenclature of FRGL is vast and complicated, with various terms used interchangeably to describe the various histopathological features of these FRGL<sup>9,10</sup>. This is best demonstrated where the terms calcifying fibroblastic granuloma, peripheral ossifying fibroma, peripheral cemento-ossifying fibroma, peripheral fibroma with calcification and ossifying fibrous epulis are used to describe the same entity in different studies<sup>11</sup>.

FRGLs are more common in females, which may highlight the influential role hormones may play in the pathogenesis of these lesions<sup>3,12,13</sup>. The binding of oestrogen to its receptor may stimulate connective tissue proliferation within the gingiva<sup>14</sup>. A predilection for the anterior regions of the jaws (incisor-canine) compared with posterior areas (premolar-molar) has also been reported for FRGL<sup>15</sup>. The anterior region predilection may be partly explained by the tendency of supragingival calculus to occur predominantly in the anterior mandibular jaw<sup>16</sup>. The pooling of saliva in the anterior mandible provides a rich source of phosphate and calcium supersaturating the dental plaque resulting in calculus formation<sup>17</sup>. The cyclical periods of wetness and dryness in the anterior maxilla associated with mouth breathing has also been implicated in the predilection of FRGL in the anterior regions<sup>18</sup>.

The average diameter for a LCH, FFH and POF is about 20 mm, but the PGCG only averages 10 mm<sup>7</sup>. If not surgically resected early LCH, POF and FFH can enlarge up to 40 mm in diameter causing difficulties with mastication and disfigurement<sup>7,19</sup>. A PGCG rarely grows larger than 20 mm, but lesions larger than 40 mm have been documented in patients with xerostomia<sup>7,19</sup>. The lack of the protective and cleansing action of saliva exacerbates the gingival irritation by calculus or plaque thus facilitating the growth of the PGCG<sup>19</sup>.

The recurrence of FRGL following the use of conventional excisional techniques is quite common<sup>20</sup>. Incomplete gingival excision, persistent gingival irritation after excision and removal of lesions using a surgical blade have been reported to increase the risk of recurrence<sup>21</sup>. Deep excisions up to the involved periodontal ligaments, removal of chronic gingival irritants and resection by carbon dioxide lasers have been reported to reduce the recurrence rate<sup>20,21</sup>. Laser

surgery is favoured because it promotes hemostasis and carbonisation of soft tissues which results in a precise clean resection<sup>22</sup>.

Other names that have been used to describe the LCH include granuloma pediculatum, pregnancy tumour, benign vascular tumour, vascular epulis and most commonly pyogenic granuloma<sup>4</sup>. The name pyogenic granuloma is misleading because no pus or pyogenic material is associated with the gingival mass<sup>10</sup>. Contamination of the granulation tissue by oral flora in a LCH can result in a fibrin exudate, which to the blind eye looks like pus<sup>4</sup>. Based on over 5200 cases of FRGL in India<sup>3</sup>, USA<sup>23</sup>, Iran<sup>24</sup> and China<sup>25</sup> the LCH comprises approximately 18% to 25% of all FRGL. This is in stark contrast with a study in Nigeria, where the LCH was the most common reactive lesion accounting for 57% of all cases<sup>7</sup>. Studies from USA<sup>23</sup>, England<sup>26</sup>, Brazil<sup>20</sup> and India<sup>27</sup> have reported that LCH has a maxillary jaw predilection. Though a study from Nigeria found no jaw predilection and one from China found a mandibular jaw predilection<sup>7,25</sup>.

POF generally presents as a pink lesion, with some authors reporting only 36% of the lesions as red<sup>5</sup>. The general histopathologic pattern is primarily of a cellular connective tissue stroma associated with mineralised components<sup>28,29</sup>. Dystrophic calcifications are more commonly seen in early growths whereas older lesions tend to have cementum or bone elements<sup>6</sup>. It is generally accepted that the POF has a maxillary jaw predilection<sup>25</sup>. Though a study in Nigeria reported that POF are equally distributed between the jaws and another study from India found all POF exclusively in the mandible<sup>7,30</sup>. The POF is generally a lesion of young females and teenagers with a peak incidence in the second and third decades of life<sup>6</sup>. In contrast, a study from China reported a higher average age of 44 years in patients with POF<sup>25</sup>.

FFH is also referred to as irritation fibroma, traumatic fibroma, fibrous epulis and fibrous nodule<sup>6</sup>. The lesion usually presents as a pink, nodular, non-ulcerated, painless gingival mass<sup>31</sup>. In studies of over 4800 reactive gingival lesions from USA<sup>23</sup>, China<sup>25</sup> and Israel<sup>31</sup> it was reported that FFH was the most common reactive gingival lesion. Though a study in Nigeria found FFH

**TABLE II: Clinical variables**

Variable	LCH (n=80)	POF (n=86)	FFH (n=69)	PGCG (n=8)	Total	P value
<b>Anatomical distribution</b>						
Anterior maxilla	37	39	30	2	108	0.978
Posterior maxilla	11	8	8	1	28	
Anterior mandible	22	29	21	3	75	
Posterior mandible	10	10	10	2	32	
<b>Pregnancy status</b>						
Pregnant	15	8	4	0	27	0.044
Non-pregnant	42	54	44	5	145	
<b>Base of attachment</b>						
Pedunculated	54	38	29	5	126	0.005
Sessile	26	48	40	3	117	
<b>Colour of lesion</b>						
Erythematous	67	43	34	2	146	0.000002
Non-erythematous	13	43	35	6	97	

**Table III: Correlation of size of FRGL and colour**

	Statistical test	Colour of lesion	P value
<b>Diameter</b>	Rank biserial correlation	0.175	0.006

**Table IV: Correlation of size of FRGL and region of jaws**

	Region of jaws (anterior/ posterior)	P value
<b>Diameter</b>	0,126	0.05

to be the third most common reactive gingival lesion<sup>7</sup>. Thus, geographical location and/ or ethnicity might play a large part in the relative frequencies of these lesions. Most studies in various countries have reported a female predilection for FFH<sup>3,23,25</sup>. In contrast a study from India reported a male predominance whilst another from Sweden reported no gender predilection<sup>30,32</sup>. There is no consensus on mean age for patients with FFH as it varies from 3rd to 5th decade of life<sup>7,31</sup>. FFH generally shows no jaw predilection<sup>23,7,31</sup>. However two studies from Sweden and China reported a mandibular jaw predilection<sup>25,32</sup>.

PGCG has been referred to as giant cell epulis and peripheral giant cell reparative granuloma<sup>6</sup>. PGCG usually presents as a purple to dark red gingival mass<sup>14</sup>. The extensive haemorrhage associated with the lesion will result in accumulation of hemosiderin that will impart the bluish hue<sup>2</sup>. PGCG was the least common reactive gingival lesion in most studies accounting for generally less than 11% of all lesions<sup>7,23,25,31</sup>. However, a study from Iran reported the PGCG as the most prevalent reactive gingival lesion<sup>24</sup>. The lesion is most common in the fourth decade of life and shows a mandibular jaw predilection<sup>31</sup>. On gender distribution, studies of PGCG have reported mixed results. While some studies reported no gender predilection<sup>23,33</sup>, others reported either a predilection for females<sup>32,34</sup> or males<sup>24</sup>.

## AIM

The aim and objectives of the study were to determine the relative frequency and distribution of FRGL according to sex, age, and anatomical site in patients who presented at the Witwatersrand Oral Health Centre.

## Methodology

### Sampling method

Utilising convenience sampling of patient records from the Department of Oral Pathology and the Department of Oral Medicine and Periodontology at the Witwatersrand Oral Health Centre, a retrospective cross-sectional study was performed. Past dental records from the years 2011 to 2017 were evaluated to select those with a histopathological diagnosis of FRGL.

### Inclusion and exclusion criteria

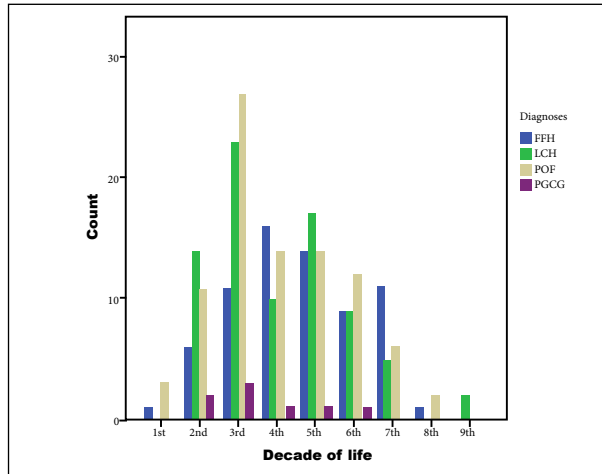
Inclusion criteria were all patients who had dental records that contained at least 70% of the data required for the study<sup>35</sup>. The exclusion criteria for this study were (1) records of patients on anti-convulsant drugs, calcium channel blockers or the immunosuppressant cyclosporin, (2) cases diagnosed as epulis fissuratum, (3) reactive lesions presenting on sites other than the gingiva and (4) neoplastic conditions.

### Data collection and variables

Histological and clinical history was obtained from the dental records. Sociodemographic variables (age, sex and occurrence of lesion during pregnancy) and clinical features (pedunculated/sessile lesion, size of lesion, colour, region of jaw affected) were recorded. Gingival lesions were anatomically classified into the following regions anterior (incisor-canine region) and posterior (premolar-molar region) according to the guidelines of Mergoni et al., 2015<sup>36</sup>. If the mass occupied both regions, it was grouped in the location where the bulk of the lesion was found<sup>36</sup>.

### Data analysis

The relative frequency of histologically confirmed cases of FRGL was analysed by determining what percentage of the total number of histopathology cases analysed in the study was either LCH, POF, FFH or PGCG. For sex, base of attachment and anatomical sites, descriptive statistics were used. For the continuous variables such as age and size of lesions, the Shapiro-Wilk test was used to

**Figure 1.** Frequency of FRGL and decade of life

assess whether data followed a normal distribution. Cross-tabulation analysis was used to summarise the categorical data. The chi-square test was used to assess statistically significant differences for categorical variables. Spearman rank correlation coefficient was applied to assess the correlation between age and size of FRGL. Rank biserial correlation coefficient ( $R_{rb}$ ) was used to analyse the correlation between, 1 size of FRGL and sex, and 2 size of FRGL and the jaw affected. The significance level alpha ( $\alpha$ ) was set at 0.05 for all statistical tests.

### Ethical considerations

Ethical clearance was obtained from the Human Research Ethics Committee of the Faculty of Health Sciences at the University of the Witwatersrand (M180672).

## RESULTS

A total of 243 cases of FRGL were evaluated and all were included in the study as per selection criteria. Female patients accounted for 70.8% ( $n = 172$ ) of all FRGL (Table I). The size of FRGL ranged from 4mm to 52mm in greatest diameter and the age of patients in this cohort ranged from 3 months to 88 years. The age did not follow a normal distribution (Shapiro-Wilk test  $p > 0.05$ ). The recurrence rates of FRGL were 22.2% ( $n = 54$ ) (Table I); with no statistically significant difference in recurrence rates between males and females.

A total of 56.0% ( $n = 136$ ) of the lesions occurred on the maxilla. Of the 243 cases, 183 (75.3%) were located anteriorly (incisor-canine region) and 60 (24.7%) cases were located posteriorly (premolar-molar region) Table II. A total of 11.1% ( $n = 27$ ) of the lesions were associated with pregnancy, whilst pedunculated lesions accounted for 51.9% ( $n = 126$ ) (Table II).

A total of 60.1% ( $n = 146$ ) of all lesions were erythematous; and the correlation between the colour and the size of FRGL was statistically significant;  $p$  value=0.006 (Table III).

The correlation of size of the FRGL and region of jaws affected (incisor-canine/ premolar-molar) yielded statistical significance;  $p$  value = 0.05 (Table IV). The correlation between size of FRGL and age of patients was not statistically significant ( $p = 0.661$ ). The frequency of the various FRGL and decade of life are shown in Figure 1. LCH, POF and PGCG were more frequent in the 3rd

decade of life, whilst the FFH was more common in the 4th decade.

## DISCUSSION

There is no consensus in the literature on which gingival variant is the most frequent FRGL; with most authors citing either the LCH or FFH<sup>7,23,31</sup>. In this study where 243 cases of FRGL, POF (35.4%,  $n = 86$ ) was the most common, a feature not seen in any recent study utilising similar classification and methodology. The only comparative result found was by Macleod and Soames(1987) in England where POF constituted 40.5% of all gingival epulides<sup>26</sup>. The variation noted in this study may be partly accounted for by the differences in geographic and ethnic factors. Some authors argue that there is bound to be an overlap in histopathological diagnosis since FRGL represent a spectrum of one lesion, thus representing another possible source of the variation. Within a South African setting, this may be linked to challenges in accessing oral health care services, with resultant delayed diagnosis.

Studies in Chile<sup>16</sup> and India<sup>37</sup> contrary to our findings, found the POF to be the least common FRGL with a frequency of only 2.9% and 9.7% respectively. In most countries the frequency of POF, ranged from 10% to 25%, representing the 2<sup>nd</sup> or 3<sup>rd</sup> most common FRGL<sup>7,23,25,31</sup>.

With a frequency of 32.9% the LCH was the second most common FRGL in this study. This agrees with most global studies that peg the frequency of LCH between 25% and 35% of all FRGL<sup>16,23,31,37</sup>. However contrary to our results, a study in Nigeria found the LCH to be the most frequent FRGL with a frequency of 57.0%<sup>7</sup>. The frequency of FFH across the globe is widely dispersed, ranging from 18.9% in Iran<sup>1</sup> to 71.1% in Chile<sup>16</sup>. The frequency of FFH in this study was 28.4% and is comparable to the 31.8% found in Israel<sup>31</sup>. PGCG was the least common FRGL in this study, a feature also seen in other studies<sup>2,7,16</sup>.

Numerous scholars have reported that FRGL have a predilection for females<sup>3,23,25</sup>, this study also found similar findings, with all four variants of FRGL occurring more commonly in females. Females accounted for 70.8% of all lesions which is comparable to 74.2% reported in Brazil<sup>2</sup>, and marginally more than the 62.7% reported in Nigeria<sup>7</sup>.

FRGL were significantly associated with pregnancy ( $p = 0.044$ ), with most cases linked to the LCH (55.6% of all pregnancy cases diagnosed as LCH). This phenomenon was likely due to the vascular effects of female hormones on the gingiva<sup>2</sup>.

There was no statistically significant difference between frequency of FRGL in the maxilla and mandible. The frequency of FRGL in the maxilla was 56.4%, slightly higher than the results seen in Israel (52.2%)<sup>31</sup> and Nigeria (50.0%)<sup>7</sup>. Only the PGCG had a higher frequency in the mandible (62.5%), a trend which has also been seen in Nigeria<sup>7</sup>, Israel<sup>31</sup> and Sweden<sup>32</sup>.

Most lesions were located anteriorly (incisor-canine region), as was observed in Brazil<sup>2</sup>. The pooling of saliva in this area favours calculus formation, which may result in gingivitis and most likely FRGL eventually. There was a statistically significant relationship between FRGL and colour ( $p = 0.000002$ ). LCH was the lesion mostly associated with erythema, with 83.8% of all LCH presenting as erythematous,

slightly higher than the 75.0% recorded in Brazil<sup>6</sup> and 73.8% in Pakistan<sup>38</sup>. The bulk of the LCH lesion is angiomatous tissue formed from endothelial proliferation thus explaining the erythema<sup>6</sup>. In this study 50.0% of POF were shown to be erythematous, a finding which is higher than the 36.0% and 33.4% recorded in Brazil<sup>2</sup> and Pakistan<sup>38</sup> respectively. In this study 49.3% of FFH were erythematous which is comparable to the 55.1% reported in Pakistan<sup>38</sup>. Only 25% of the PGCG in this study were erythematous this might be due to the variation in the amount of hemosiderin or extravasated blood in various PGCG lesions which results in a wide spectrum of colours at presentation that include red, bluish, pink and pale pink<sup>3</sup>.

In this study 74.9% (n = 182) of all FRGL were greater than 10mm, similar findings were also reported in Pakistan<sup>38</sup>. The FRGL ranged from 4mm to 52mm, mirroring findings in Nigeria<sup>7</sup>. Like the study in Nigeria<sup>7</sup>, the average size of the LCH was found to be the largest of all FRGL. There was a low but statistically significant correlation between the size of FRGL and the colour of the lesions (Rank biserial correlation = 0.175), with erythematous lesions being generally larger. Low statistically significant relationships were also found between the size of FRGL and location of lesion (anterior/posterior, Rank biserial correlation = 0.126). Lesions tended to be larger in the posterior region, and this could be partly explained by the fact that patients are more likely to seek treatment earlier for anterior lesions because of a higher aesthetic demand. There was no statistically significant correlation between size of FRGL and age of patients (p = 0.661), with the largest lesion occurring in a 19-year-old female patient.

The youngest patient in the study was 3 months old and was diagnosed with a POF. The baby was healthy and was born with anterior mandibular teeth that later exfoliated. Similar cases have been reported in literature, with the authors assuming the irritation in the periodontal ligament that results from exfoliation may trigger gingival connective tissue metaplasia with resultant dystrophic calcifications<sup>39</sup>. POF, LCH and PGCG occurred more frequently in the 3rd decade of life, with similar results being reported in Nigeria<sup>7</sup> and Israel<sup>31</sup>. FFH was more common in the 4th decade, a feature also noted in Israel<sup>31</sup>, though a study in Nigeria<sup>7</sup> and Chile<sup>16</sup> found lesions more common in the 3rd and 6th decade respectively.

The mean age of patients with POF was 34.7 years, which is comparable to 33.9 years reported in Israel<sup>31</sup> and 31.5 years reported in the USA<sup>23</sup>. Though mean age for POF was noted to be way higher in China at 44.2 years<sup>25</sup>. The mean age for a LCH was 35.3 years, with similar mean ages being reported in the USA<sup>23</sup> and China<sup>25</sup>. The lower mean age for POF compared to LCH does not corroborate the progressive development theory, that postulates that a POF evolves from of LCH via further collagenisation and mineralisation<sup>8</sup>. Thus, this brings into question whether the LCH and POF are the same lesion at various histopathological developmental stages.

There was no statistically significant difference in the recurrence rates of FRGL in this study. The recurrence rate of 22.2% recorded in this study is higher than the 2.9% reported in Nigeria<sup>7</sup>. The POF and FFH had the highest and lowest recurrence rates respectively, a feature

also reported in India<sup>21</sup>. There was also no statistically significant difference in recurrence rates between males and females, hence female hormones may not be key to recurrence rates.

### Limitations of study

The study fell victim to a major hurdle of retrospective studies, that is, all information gathered is solely dependent on the available information in the dental records. Unfortunately, this resulted in insufficient data being gathered on race, plaque index, DMF index, nature of chronic irritation and presence of ulceration. Pregnancy status evaluation was solely based on information gathered on the dental chart, thus some early unknown pregnancies may have gone undetected. Since FRGL in dental charts were mostly classified either as erythematous or non-erythematous rather than specify the true colour of the lesion this might have been a source of error.

### CONCLUSION

As in most studies the FRGL were more common in females in this study. Contrary to results of similar studies done in other countries, POF was the most common variant of FRGL after analysing 243 cases in this study. Statistical differences for FRGL were noted on pregnancy, base of attachment (sessile and pedunculated) and colour of lesions. An understanding of the clinical picture may aid in the diagnosis of FRGL, but histopathological evaluation is still required for a definitive diagnosis.

Retrospective studies are heavily dependent on data available in patient records. Given the amount of missing data encountered in the study, we recommend detailed and accurate documentation of findings by clinicians in order to facilitate future research. Based on our findings that do not corroborate the progressive development theory of POF from LCH, we recommend more studies on the histopathogenesis of FRGLs.

### Conflict of Interest

No conflict of Interest. Research was self-funded.

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# Predictable sedation: Safe administration of oral Midazolam and nitrous oxide gas for paediatric patients in the general dental practice

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## ABSTRACT

### Introduction

Behaviour management for anxious paediatric dental patients is challenging. Solutions include education and sedation. Various drugs have been used to effectively sedate paediatric patients during treatment.

### Aims and objectives

The aim of this study was to review literature on the sedation of paediatric patients. The study specifically looked at those reviews covering the combination of two sedation methods in case of more challenging paediatric patients.

### Design

The study undertook a literature review focused on studies using nitrous oxide, Midazolam, or a combination of the two substances.

### Methods

An electronic search was done on EBSCOhost to source articles published from 1979 to 2019.

### Results

A deeper form of sedation can be achieved for paediatric patients when using a combination of nitrous oxide, oxygen and a hypnotic agent such as Midazolam.

### Conclusion

Dealing with the anxiety levels of paediatric patients is a challenge for dental health providers. Two of the main strategies used to deal with anxious children are behaviour management and sedation. A critical review of

journal articles on the use of nitrous oxide and oxygen in combination with Midazolam was therefore undertaken. The findings suggest that, in order to achieve a deeper form of sedation, the combination of nitrous oxide, oxygen and Midazolam works well to reduce discomfort, anxiety and/or pain in paediatric patients.

### Keywords

Benzodiazepine, dental, Midazolam, nitrous oxide, paediatric, paedodontics, sedation.

## AIM

The aim of this study was to review the literature on the sedation of paediatric patients, i.e. patients up to the age of 21 years. The literature review specifically focused on studies using nitrous oxide, Midazolam, or a combination of the two substances. An electronic search was done on EBSCOhost to source articles published over the last 40 years, i.e. articles from 1979 to 2019.

## INTRODUCTION

### Paediatric dentistry

Children frequently find dentistry challenging, as it induces anxiety. There are various reasons for this:<sup>1</sup> Often, children's coping skills are not sufficiently developed to deal with such situations. As a result, they behave fearfully.<sup>2</sup> Their anxiety and resultant behaviour can be linked to negative outcomes such as amplified oral ailments, evading dental treatment, and defiance.<sup>3</sup> Behaviour management for young paediatric dental patients may therefore be challenging for both the child and the dentist.<sup>4</sup>

Note that in this paper, the term paediatrics is used to describe children and young people under the age of 21 years.<sup>5</sup> According to The South African Children's Act No. 38 of 2005, a paediatric patient limit is 12 years of age.<sup>42</sup>

### Behavioural management

Possibly the most challenging age group for the paediatric dentist to work with is children between 15 months and six years of age.<sup>6</sup> Dealing with the anxiety levels of paediatric patients is one of the most demanding circumstances in the dental practice, making the

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undertaking of helping uncooperative children in need of dental care extremely challenging, if not impossible at times. Two of the main strategies used to deal with anxious children are behaviour management and sedation. Usually, when behaviour techniques are no longer sufficient to manage the child, the help of pharmacological substances is sought.

The dental team can educate children, as well as manage and alleviate their anxiety with suitable mechanisms aimed at eliciting appropriate and cooperative behaviour while in the dental chair. Excellent behaviour management facilitates safe, efficient and better quality treatment by the oral health team.

Children understand and react to painful stimuli in their own individual ways.<sup>7</sup> Additionally, children under the age of four years are susceptible to the experience of painful stimuli, and are usually not able to verbalise their fears. Their reactions can be influenced by listening to older children's inaccurate descriptions of negative experiences, as they too do not always understand their experiences or do not communicate these appropriately. A child's behaviour can also be negatively affected by an anxious or nervous parent.<sup>8</sup> Communication is the most important obstacle to overcome. Educating and, in essence, managing the parent before the child's first dental visit is of utmost importance. Establishing communication is the main goal for behaviour guidance; this alleviates fear and lessens anxiety. Building an undoubting connection will therefore promote a positive attitude between parent, child and the dental health provider.<sup>8</sup> This connection will set the ground work for a trusted relationship, allowing the child to be treated and handled.

Methods used by dental professionals to manage dental nervousness are principally designed to avoid unlikable and unproductive meetings with the paediatric patient. The aim is to create an atmosphere in which one can develop the child's self-confidence, thus allowing the dental oral professional to carry out procedures while limiting disruptions.

Various behaviour management techniques are employed to help prepare young children for dental procedures. Examples of behaviour management techniques are tell-show-do, positive reinforcement, modelling, behaviour shaping, desensitisation and alternative techniques (flexible control, distraction and memory restructuring).<sup>9</sup> Techniques used to improve communication with young children include distraction, non-verbal communication, voice control, tell-show-do, positive reinforcement, parental presence/absence, and protective stabilisation.<sup>7,10</sup>

To encourage the child to act in a more suitable manner in the dental clinic, the sole use of behavioural management techniques is preferred. However, this is not always possible – especially when working with fearful or anxious children, or with those who have a disability that inhibits them from cooperating with the dental team. Sedation is often needed in paediatric dentistry when the patient presents with behavioural impairment, angst and apprehension to any dental procedures, which prohibits the dental team to commence with treatment.<sup>11</sup> Sedation in paediatrics therefore becomes advisable when behavioural strategies alone have failed or are contra-indicated.<sup>5,12</sup>

The sedation of children for the delivery of dental care has been successfully executed using different drug regimens. Currently, these are the most popular sedation methods used by paediatric dentists:<sup>13,14,12,15</sup>

- Nitrous oxide inhalation sedation with oxygen alone
- Midazolam (benzodiazepine) alone, or
- A combination of both drugs.

In addition, in-office sedation is cost-effective and safer than conscious sedation and general anaesthesia. Other options include Dexmedetomidine hydrochloride (Orion Pharma, Turku, Finland)  $\alpha$ 2-adrenergic agonist, CHLORAL HYDRATE (Pocral®, Hanlim Pharmaceuticals Inc., Seoul, Korea) inhibitory action on the cerebral hemisphere of central nerve system and General anaesthesia [The alternative of oral sedation for paediatric dental care.<sup>43</sup>

### Nitrous oxide

Nitrous oxide ( $N_2O$ ) gas, commonly referred to as laughing gas, is a method used for sedation.  $N_2O_2$  presents itself as an odourless and colourless gas. The technique is effective because it results in a pleasurable feeling, which in turn relaxes the patient. The drug is fast acting, and its effects can be rapidly and effortlessly reversed when needed. For this reason, it is considered to be a safe method of sedation.<sup>16,17,22</sup>

### Midazolam

Midazolam is a short-acting benzodiazepine derivative used to produce sleepiness or drowsiness and to relieve anxiety before surgery or certain procedures. When Midazolam is used before surgery, the patient will not remember some of the details about the procedure.<sup>6,32,33</sup>

## SEDATION

Most of the reviewed articles only focused on one type of sedation (i.e. either nitrous oxide gas or Midazolam), and not on the combination of nitrous oxide gas and Midazolam. This study specifically looked at those reviews covering the combination of the two sedation

**Table I.** The effect of different types of sedation on children<sup>24</sup>

	Minimal sedation anxiolysis	Moderate sedation/Analgesia ('conscious sedation')	Deep sedation / Analgesia	General anaesthesia
<b>Responsiveness</b>	Normal response to verbal stimulation	Purposeful response to verbal or tactile stimulation	Purposeful response following repeated or painful stimulation	Unarousable even with painful stimulus
<b>Airway</b>	Unaffected	No intervention required	Intervention may be required	Intervention often required
<b>Spontaneous ventilation</b>	Unaffected	Adequate	May be inadequate	Frequently inadequate
<b>Cardiovascular function</b>	Unaffected	Usually maintained	Usually maintained	May be impaired

methods in order to inform the general dentist, chair assistant and specialist about the outcomes of combining two sedation methods in case of more challenging paediatric patients.

Sedation, which is the consequence of a down regulation of state, is short of anaesthetic sleep. Ideally, sedation produces sleepiness or drowsiness with euphoria and muscular relaxation, but not full anaesthetic sleep. A short time after administration, the agent should be effectively absorbed. The rapid effect of sedation allows treatment to begin almost immediately. The agent should be able to be promptly reversed, allowing for a speedy recovery.

Anxiety tends to lessen the pain threshold. Hence, it is imperative to have an agent that has a sedative effect as well as an anxiolytic effect. Amnesia is a welcome side-effect for sedation and for sedative drugs.<sup>5</sup> The General Dental Council (GDC) describes sedation as: 'A technique, of depressing the central nervous system by a drug, allowing for execution of planned treatment to be done whilst maintaining lingual communion throughout the duration of sedation. The sedation level should allow for the reflex behaviours to be maintained to protect the airway specifically the pharynx from aspiration, allow the patient to remain conscious and be able to comprehend and react to spoken instructions.'<sup>9,21</sup> Many different drugs have been employed to effectively sedate paediatric patients during dental care treatment.<sup>9</sup>

One of the more favourable sedation techniques used by paediatric dentists is the combined use of the inhalation of nitrous oxide (N<sub>2</sub>O) and oxygen (O<sub>2</sub>), as a sedation alone or, in combination with Midazolam.<sup>22</sup> Moderate sedation can be successfully administered in the clinical management of a paediatric dental patient, with both intranasal and oral sedation using Midazolam in combination with nitrous oxide gas.<sup>23,15</sup>

## SEDATION IN THE PAEDODONTICS PRACTICE

Team effort and discussions are required to decide whether or not to sedate a paediatric patient. Decisions about which sedation technique to use, the mode of delivery and the type of agent depend on the suitability of the sedation techniques for that child and caregiver. General anaesthesia (GA) in paediatric patients is always risky for the following reasons:<sup>17</sup>

- Children have a somewhat larger epiglottis and tongue
- The head-to-body ratio of children
- Children have a different (higher) metabolic rate compared to adults
- Children's adenoid mass
- Children's anterior and higher vocal cords
- Children have a smaller, less developed and retrognathic mandible
- Children have a smaller lung capacity
- Children have less oxygen reserves, so they can desaturate more quickly than adults do.

An effective drug should assist with anxiety management (anxiolysis) using minimal sedation and allowing patients to respond naturally and routinely to verbal commands.

Cardiovascular and upper respiratory functions should remain unaffected. However, cognitive function and physical coordination may be impaired.<sup>24</sup>

## PATIENT SELECTION

When selecting a specific form of sedation, the pre-operative evaluation should comprise a meticulous medical history (including all chronic and acute medication) and dental history, prior hospitalisations and operations. In addition, according to the American Society of Anesthesiologists (ASA), physical status classification ought to be determined as part of the patient's assessment.<sup>25</sup> Table II below summarises the ASA classification.

Scale	Description
<b>Class I</b>	Normal healthy patients
<b>Class II</b>	Patients with mild systemic disease
<b>Class III</b>	Patients with severe systemic disease that is limiting but not incapacitating
<b>Class IV</b>	Patients with incapacitating disease that is a constant threat to life
<b>Class V</b>	Patients not expected to live more than 24 hours

**ASA = American Society of Anesthesiologists  
From: Department of Health, 2007**

Paediatric patients who fall under ASA Class I or Class II (see Table III) are deemed fit to receive sedation in a general paediatric practice. Those in Classes III to V should be treated in a hospital environment.<sup>9</sup> Should the child have a history of recent respiratory illnesses or common infections, then the airway, weight and vital signs should be assessed before general anaesthesia is administered.

The employment of basic monitoring devices such as a pulse oximeter and blood pressure cuff is somewhat mandatory for lighter sedation techniques and highly recommended.<sup>17</sup>

## PATIENT MONITORING

Regulatory bodies and professional associations with advanced technology have provided the framework for the safe and effective practice of patient sedation. Clinicians' sedation techniques in earlier times were largely unregulated, usually only relying on direct clinical findings such as physical rate of respiration and signs of cyanosis to assess the sedated patient.<sup>26</sup> Safety increased when regular monitoring became normal practice. Observation includes the use of a pulse oximeter for the electronic monitoring of blood oxygen saturation levels, pulse and blood pressure.<sup>27</sup> An oxygen saturation level of 90 O<sub>2</sub> or below should be seen as alarming for a 4- to 6-year-old patient undergoing a dental procedure (a level of 95 O<sub>2</sub> and above is acceptable).

## INHALATION SEDATION

The technique of inhalation sedation analgesia using nitrous oxide gas can be used to control pain. Nitrous oxide gas is a weak anaesthetic agent that is very useful in alleviating anxiety in patients. The use of N<sub>2</sub>O is safe and effective for children who are anxious but cooperative. It is a reasona-



bly simple technique to use as an adjunct to dental care, assisting patients to accept routine operative dental care. The acceptance of the mask can be made more favourable when lending out the mask to the patient and parents to role-play at home. This makes inhalation sedation a safe and relatively easy technique to use. In addition, inhalation sedation has a quick induction and it is completely reversible, with a short recovery time. Nitrous oxide gas can be titrated to the desired level of sedation. Contra-indications include, but are not limited to, a blocked nose, severe psychosis, cystic fibrosis, chronic upper airway obstructions (due to large adenoids), intercommunication problems, reluctant patients, pregnancy and acute respiratory tract infections.<sup>28</sup> Nausea is often induced due to fluctuating concentrations of N<sub>2</sub>O<sub>2</sub> resulting in alternative mouth and nose breathing. Patients receiving nitrous oxide sedation may continue with their normal daily routines upon discharge from the practice or clinic.<sup>29</sup>

Nitrous oxide (N<sub>2</sub>O) inhalation sedation is used by 85% of paedodontics for dental sedation.<sup>6</sup> However, it has a proven high-technique sensitivity and as a single-drug sedation it has a low potency. In order to overcome the shortcomings of both drug routes, i.e. Midazolam and N<sub>2</sub>O, the N<sub>2</sub>O inhalation technique is frequently used in combination with oral medications.<sup>6,30,31</sup>

## ORAL SEDATION

Oral sedation is one of the most popular routes due to the ease of administration for most children. Benzodiazepines, Midazolam, chloral hydrate, ketamine, hydroxyzine, Promazine and Fentanyl are commonly used drugs in this context.

The popularity and usage of Midazolam has increased over the past decade due to its safety record and short-acting nature. It allows for relatively quick recuperation and for the almost immediate safe discharge of the patient. The oral dosage of 0.3 to 0.7mg/kg, and a maximum dose of 10mg for older children, is used.<sup>17</sup>

An example of an ideal situation is the following:

- **Child:** aged 6 to 8 years
- **ASA classification:** 1 or 2
- **Type of procedures:** short procedures
- **BMI:** should be ideal
- **Discharge:** Caregiver able to look after child after procedure.

Children older than six years may be more difficult to manage due to them being more disinhibited and having more paradoxical reactions while children with a higher BMI may have trouble with airway management. Children should have fasted for a few hours to avoid vomiting after the procedure. A significant limitation of the oral route is that it cannot be titrated accurately as it has a hepatic metabolism route, unlike gas which is easier to titrate.<sup>10</sup>

## COMBINATION OF AGENTS

To achieve a deeper form of sedation, nitrous oxide, oxygen and hypnotic agents (benzodiazepines, anti-histamines, chloral hydrate and opioids) may be combined.<sup>1,32,33,34,35,36</sup> Midazolam and nitrous oxide in amalgamation with oxygen are the pharmacological agents mainly used for the treatment and management of dental anxiety, mainly in children.<sup>19</sup>

Nitrous oxide given concurrently with drugs like Midazolam increases its effect.<sup>37</sup> Various research articles have recorded the efficiency and safety of using nitrous oxide with other sedative drugs in children who were uncooperative. Nitrous oxide potentiates the sedative effects of benzodiazepines in sedation. The N<sub>2</sub>O mixture enhanced the duration of action of the Midazolam, and this duration was well suited to the dental environment.<sup>2</sup> Although successful sedation events were established, an elevated occurrence of overdose was associated due to adverse sedation events when combinations of drugs were administered.<sup>36</sup>

In children with cerebral palsy, Valium can be used as its side-effects include drowsiness due to its antihistamine properties. The draw-back is its long half-life.<sup>38</sup>

In the 2018 article by Bourke and Phadraig, it was found that nitrous oxide and Midazolam as sedative agents were uniformly safe and effective for the use in healthy young children in a hospital setting.<sup>1</sup> Both trials on nitrous oxide and Midazolam observed no incidence of patients suffering respiratory depression, with a low prevalence of excitatory behaviour. Any desaturation recorded remained inside acceptable clinical limits in all trials. This emphasised the safety of both these techniques. While testing Midazolam and nitrous oxide separately, they found that the Midazolam and nitrous oxide had fairly identical results relating to behaviour management and sedation. However, in a

**Table III:** Description of Class I and Class II of ASA's physical status classification<sup>8</sup>

Class	Original
I	<p>No organic pathology or patients in whom the pathological process is localized and does not cause any systemic disturbance or abnormality.</p> <p>Examples: This includes patients suffering with fractures unless shock, blood loss, emboli or systemic signs of injury are present in an individual who would otherwise fall in Class I. It includes congenital deformities unless they are causing systemic disturbance, infections that are localized and do not cause fever, many osseous deformities and uncomplicated hernias are included. Any type of operation may fall in this class since only the patient's physical condition is considered.</p>
II	<p>A moderate but definite systemic disturbance caused either by the condition that is to be treated or surgical intervention or which is caused by other existing pathological processes forms this group.</p> <p>Examples: Mild diabetes. Functional capacity I or IIa. Psychotic patients unable to care for themselves. Mild acidosis. Anemia moderate. Septic or acute pharyngitis. Chronic sinusitis with postnasal discharge. Acute sinusitis, minor or superficial infections that cause a systemic reaction. (If there is no systemic reaction, fever malaise, leucocytosis etc. aid in classifying). Nontoxic adenoma of thyroid that causes partial respiratory obstruction. Mild thyrotoxicosis. Acute osteomyelitis (early). Chronic osteomyelitis. Pulmonary tuberculosis with involvement of pulmonary tissue insufficient to embarrass activity and without other symptoms.</p>

single experiment they found nitrous oxide to be more effective than oral Midazolam in relieving anxiety, and with fewer adverse effects.<sup>39,40</sup> Sole pharmaceutical treatment with a single dose of Midazolam took longer than with nitrous oxide to gain effectiveness.<sup>1</sup> Poor behaviour of paediatric dental patients has shown no effect on oxygen saturation. However, it has predictably shown an increase in the pulse rate of children under sedation with Midazolam and nitrous oxide.<sup>41</sup> There were no significant differences in the general behaviour of patients when using either the nitrous oxide or the Midazolam technique. However, the combination of nitrous oxide and Midazolam helped with stressful situations such as injections of local anaesthesia, sleep drowsiness, crying and movements.<sup>15</sup> As a result, nitrous oxide or oxygen at 40% with Midazolam may allow the patient to tolerate unpleasant procedures by reducing discomfort, anxiety and/or pain.<sup>41</sup>

In a Drug Bank study, 0.5 mg/kg Midazolam, 1 mg/kg Promethazine and 50% N<sub>2</sub>O/50% oxygen were administered, which was in line with previous investigations where the subjects presented with amnesic effects.<sup>18</sup> Adding N<sub>2</sub>O is permitted with all sedation methods, leading to increased sedation and improved oxygen delivery to the patient.<sup>18</sup> A concentration of 50% N<sub>2</sub>O/50% oxygen provides a safe anxiolytic/analgesic effect by activating the opioid and gamma-aminobutyric acid receptors.<sup>4</sup> Preceding researchers advocated 0.5 mg/kg Midazolam, as no difference was seen in sedating efficacy of 0.5, 0.75, and 1 mg/kg Midazolam and some side-effects were reported with 1 mg/kg Midazolam.<sup>18</sup>

## CHALLENGING ROLE OF DENTAL ANAESTHESIA

Children's behaviour in the dental office is becoming more difficult to manage, which is aggravated by parents becoming increasingly particular about their child's experience and interfering with treatment. In addition, sedation dental practitioners face considerable challenges to achieve the described levels of child-centred care.<sup>27</sup>

## CONCLUSION

Providing superior dental care to young paediatric patients can be challenging. Preserving the child's trust by providing minimal traumatic treatment is the main objective of paediatric dental sedation and treatment. To specifically create a high standard for safety and to incorporate this into the clinical practice, practitioners should strive to reduce patient risk by vigilantly selecting patients who are medically sound for sedation.

Two of the main strategies used to deal with anxious children are behaviour management and sedation. Usually, when behaviour techniques are no longer sufficient to manage the child, the help of pharmacological substances is sought. A critical review of journal articles on the use of nitrous oxide (N<sub>2</sub>O) and oxygen (O<sub>2</sub>), as a sedation alone, or in combination with Midazolam, was therefore undertaken. The findings suggest that, in order to achieve a deeper form of sedation, the combination of nitrous oxide, oxygen and a hypnotic agent such as Midazolam works well, allowing paediatric patients to

tolerate unpleasant procedures by reducing discomfort, anxiety and/or pain.

It is anticipated that the need for safe dental sedation will grow in the future, given the parents' preference and the towering incidence of paediatric dental disease.<sup>26,27</sup>

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# Deep neck space infections in Adolescents

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## ABSTRACT

### Objectives

Adolescent deep neck space infection is an important pathology that often requires hospitalization for antimicrobial therapy. The aim of the study was to identify the inciting organisms and their resistance profiles in the adolescent population of patients with deep neck space infection.

### Methods

We performed a single-center cross-sectional retrospective analysis of patients between 10 and 16 years of age, with deep neck space infections.

### Results

From the 319 cases of deep neck space infections that presented over the study period, nine patients met the criteria to be included in the study. The mean age being 11.8 years.

The microbiology of the specimens revealed mainly *Staphylococcus* and *Streptococcus* species and in some patients microscopy and culture showed no predominant bacteria. There was an overall 86% resistance of organisms to penicillin and ampicillin but most organisms were sensitive to amoxicillin-clavulanic acid

### Conclusion

Deep neck space infections in adolescents can initially be managed with amoxicillin-clavulanic acid, source control and surgical drainage if required. Culture directed therapy can be initiated after microbiology results. The spaces involved are similar to adults with 44% of patients having deep neck abscess secondary odontogenic infection. The microbiology however is similar to that of children with *Streptococcus* and *staphylococcus* species being the most predominant.

## INTRODUCTION

Adolescent deep neck space infection is an important pathology that often requires hospitalization for antimicrobial

therapy. These infections are a distinct entity from adult and pediatric deep neck space infections as adolescence marks this transition from childhood to adulthood. Adolescence is accompanied by significant anatomical and physiologic changes. Jacqueline et al. conducted a study of immune function in adolescents and discovered a unique level of immunity in this group compared to adults and younger children. This is thought to be as a result of hormonal influences during this period of life.<sup>1</sup>

Age related anatomical differences influence the location of deep neck space infections.<sup>2</sup> Therefore, a thorough understanding of the anatomical fascial planes which serve as a natural defense mechanism against spread, is vital for understanding the spread of disease patterns of inciting organisms seen at different anatomical sites, and treatment.<sup>3</sup>

Infections affecting deep neck spaces include lymphadenitis, cellulitis, necrotic nodes and abscesses.<sup>4,5</sup> Ear, nose or throat infections may spread to these spaces via contiguous or lymphatic spread and may lead to abscess formation and subsequent life-threatening complications if left untreated.<sup>6</sup>

According to Lawrence, et al. in 2017, peritonsillar space infections are generally due to acute tonsillitis which often occurs paediatric patients.<sup>7</sup> Peritonsillar abscesses are however more common in an adolescents and adults as opposed to younger children, with an average age of 25 years of patients affected.<sup>2</sup>

Submandibular space infections are usually odontogenic in origin and are therefore more prevalent in paediatrics than adults.<sup>6</sup> However, submandibular space infections may also be due to suppurative lymphadenitis, trauma to the oral cavity and upper respiratory tract infections.<sup>4</sup> Masticator space infections commonly arise as a result of infection from the third mandibular molar.<sup>4</sup> Buccal infections are also commonly odontogenic in adolescents but may be non-odontogenic in younger children.<sup>4</sup>

Parotid abscesses may occur as a result of adjacent sepsis, parotitis and sialadenitis.<sup>2</sup> These abscesses are however rare in the younger paediatric population and affected only 1% of paediatric patients in a study examining site-specific differences of deep neck space infections in children.<sup>6</sup>

Post-styloid parapharyngeal space infections are more common in children due to cervical lymphadenitis, whereas pre-styloid infections are more common in adolescents and adults due to spread from adjacent deep

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neck spaces such as submandibular, retropharyngeal, parotid and masticator spaces.<sup>7</sup>

Retropharyngeal abscesses, however, are more predominant in early childhood as opposed to adolescents as lymph nodes in these areas regress with age, and infections in this space are often due to respiratory infections, with lymph nodes in these areas draining the nose, pharynx and sinuses respectively.<sup>8</sup> Adolescents with retropharyngeal abscesses are usually affected as a consequence of trauma or foreign body ingestion which becomes secondarily infected.

Prevertebral space infection may occur as a result of direct extension of abscesses involving the vertebra or penetrating trauma.<sup>4</sup> Abscesses from the retropharyngeal, parapharyngeal spaces may spread to the danger space due to their proximity to this space. Infection in the anterior visceral space may arise from perforation of the anterior wall of the oesophagus due to trauma, foreign body ingestion or as a complication of surgery.<sup>4</sup> A study by Chang et al., demonstrated that the most commonly affected anatomical sites in the head and neck region of adolescents were the peritonsillar space followed by multispace involvement whereas younger children presented with retropharyngeal or parapharyngeal spaces followed by anterior or posterior triangle and submandibular or submental regions.<sup>2</sup>

The literature is scant with regard to deep neck infections in adolescents specifically.

Rationale for study:

1. To identify the provocative organisms and their resistance profiles in the adolescent population (between 10 and 16 years of age) of patients with deep neck space infections at Charlotte Maxeke Johannesburg Academic Hospital between 1 January 2010 and 30 December 2017.
2. To describe the subtypes of deep neck space infections seen in the adolescent population and compare that with adults and children

## Methods

Patients were identified by the admission books of the departments of pediatrics, maxillofacial and otorhinolaryngology.

**Study criteria:** Patients between 10 and 16 years of age, with deep neck space infections, who had been admitted to all wards of Charlotte Maxeke Johannesburg Academic Hospital, Gauteng, South Africa were evaluated. HIV and TB co-infection was also noted. Duration of hospitalization was used as an indicator of treatment response.

Deep neck spaces for evaluation included the submandibular, parotid, masticator, peritonsillar, parapharyngeal, retropharyngeal, pretracheal and prevertebral spaces respectively. Data was extracted from the medical records. Clinical presentation, imaging, microbiology, surgical operative reports and final outcomes were recorded and analyzed. All specimens were reassessed by a microbiologist. Management of these patients included aspiration of pus and submission to the National Health Laboratory Service for microscopy,

culture and sensitivity to guide culture-directed antimicrobial therapy.

The results of these pus specimens from the National Health Laboratory Service were evaluated and the following characteristics reviewed:

- Age
- Gender
- Microbiology of infection
- Sensitivities of antimicrobials

Laboratory data available included:

- White cell count
- Haemoglobin level
- Platelets
- C-reactive protein
- Albumin level

Ethics was approved by the University of the Witwatersrand Human Research Ethics Committee (HREC)

In addition, a PubMed search, using the mesh term 'deep neck infections adolescent', was performed for literature review. The search was limited to the English language and included articles for the last 30 years until December 2019.

## Results

### Patient Characteristics:

From the 319 deep neck infections identified, nine patients met the criteria to be included in the study. The age range was from 10 to 15 years. The mean age being 11.8 years.

There were two females and seven males identified in the study. Two patients were HIV positive and had significantly longer average duration of hospitalization when compared to their HIV negative counterparts. One of these HIV positive patients had Tuberculosis co-infection. None of the patients in the study were anemic.

### Clinical signs and symptoms:

The patients were admitted for acute neck swelling and had pyrexia, tachycardia and associated cervical lymphadenopathy. Other presenting signs and symptoms were related to the source of infection and included sore throat, trismus, otalgia, and headache. 4 patients had odontogenic infections.

The deep neck spaces of adolescents infected were the submandibular space (n=4); the parotid space (n=3); the buccal(n=2), and peritonsillar space (n=1). One patient

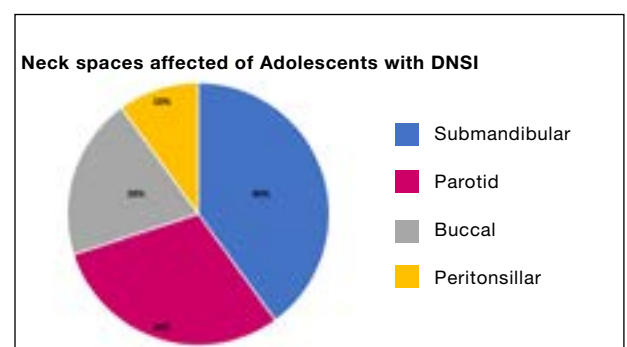


Figure 1: Neck spaces affected by DNSI in adolescent study participants

**Table 1.** Results of positive bacterial cultures

Microorganism	Percentage of patients	Sensitive to	Resistant to
Aerobic			
<i>Staphylococcus aureus</i>	28.5	Cloxacillin Clindamycin Cotrimoxazole	Penicillin Ampicillin
<i>Streptococcus anginosus</i>	14.2	Penicillin	Nil
<i>Streptococcus constellatus</i>	28.5	Cefotaxime	Penicillin Ampicillin
<i>Proteus mirabilis</i>	14.2	Amoxicillin and clavulanic acid	Penicillin Ampicillin
Anaerobic			
<i>Bacteriodes fragilis</i>	14.2	Amoxicillin and clavulanic acid	Penicillin Ampicillin

had multi-space involvement with infection of the buccal and submandibular spaces respectively. (Figure 1)

### Imaging

In all patients, deep neck infection (DNI) was confirmed by radiologic investigations. Depending on the underlying pathology, availability of resources and patient characteristics, imaging consisted of ultrasonography, contrast-enhanced CT and/or MRI scan.

### Micro-organisms

The microbiology of the specimens revealed: *Staphylococcus aureus*, *Streptococcus anginosus* and *Streptococcus constellatus*. (Table 1)

One patient with HIV had polymicrobial infection with *Streptococcus constellatus*, *Proteus mirabilis* and *Bacteriodes fragilis*. The other HIV infected adolescent patient had tuberculosis sensitive to isoniazid (INH). There was an overall 86% resistance of organisms to penicillin and ampicillin. (Table 1)

### Blood results

The average white cell count of patients with deep neck space infection was 9.47 (range 4.86 to 21.96), and C-reactive protein was 62 (range 11 to 259). Interestingly, patients with highest white cell counts and CRP levels on admission had the shortest duration of hospitalization. (Table 2)

### Treatment

All patients were initially treated with empiric intravenous antibiotics. This was amoxicillin/clavulanic acid at the following doses:

- Patients 40 kg and over: Usually 1.2 g 8 hourly.
- Patients 10-12 years: 30 mg/kg 8 hourly.

Culture directed therapy was later initiated following microbiology and sensitivities of organisms isolated. The duration of antibiotic treatment was dependent on the patient's clinical response to treatment. The days in hospital ranged from 1 to 12 days, the average being 5.8 days.

Surgery was performed for appropriate source control to drain any collections greater than 3 cm that was identified on imaging. This was done either intraorally for odontogenic infections with dental extractions (n=4) or through an external neck incision under general anesthetic.

Five (55.6%) pus cultures were obtained via surgical drainage. Preceding upper respiratory tract infection n=5 (56%) and dental infection n=4 (44%), were the leading causes of Deep neck infection.

### Outcomes

All the patients improved on intravenous antibiotic treatment and surgical drainage when required.

The HIV infected patients had a much longer average duration of hospitalization of 8.5 days, indicating a delayed response to treatment. The patients were discharged and had follow-up at the out-patients clinic. The acute infection had completely resolved and there was no recurrence on follow up. Treatment for extra-pulmonary Tuberculosis was initiated for the patient with positive TB culture and was continued for a total of 9 months with complete treatment response.

### Discussion

Deep neck space infection is defined as infection in the potential spaces and fascial planes of the neck.<sup>2</sup> Ear, nose or throat infections may spread to these spaces directly or via the lymphatic system.<sup>4</sup> Considering that we live in a developing nation burdened with HIV and other infections such as TB, compounded by the problem of malnutrition and poor access to healthcare, DNSI in our setting may have dire consequences. These complications include airway compromise, jugular vein thrombosis, carotid artery aneurysm or rupture, mediastinitis and sepsis.<sup>2</sup> According to a study by Sittitrai et al. in 2018, HIV infected patients with deep neck space infection have a higher complication rate and a higher risk of mortality.<sup>9</sup> Despite HIV or TB co-infection, none of the adolescents with deep neck space infection had complications during the course of disease in our study. This may reflect a protective mechanism due to hormonal influences on immunity during adolescence.<sup>1</sup>

In one study, 113 pediatric patients were hospitalized with maxillofacial infections with 32 from dental sources; however, the extension of these infections into deep neck spaces was not documented. In a similar study of 67 paediatric patients with abscess of the head and neck, only 15 cases were determined to have submandibular, parapharyngeal, or retropharyngeal space involvement, and only nine were attributed to dental infection.<sup>4,5,10-13</sup> In our study the submandibular space was the most affected across all adolescents. Submandibular space infections are usually odontogenic in origin and are less

**Table 2.** Blood results of Adolescents with DNS

Patient No.	Gender	Age	White cell count	Hb	Platelets	CRP	HIV result
1.	Male	10	6.74	11.9	475	45	-
2.	Female	10	4.86	13.51	278	22	+
3.	Male	11	10.2	14	237	117	-
4.	Male	11	6.5	11.9	612	47	-
5.	Male	10	7	13.1	413	35	-
6.	Male	13	5.0	11.8	345	11	+
7.	Male	14	11.6	12.1	389	13	-
8.	Male	15	21.96	12.9	258	259	-
9.	Female	13	11.4	12.4	320	15	-

prevalent in babies or younger children than adolescents. This is in keeping with international trends.<sup>6-8</sup>

It is also evident that although retropharyngeal abscesses are commonly seen in some countries in the younger pediatric population, it is relatively rare in the adolescent population due to the regression of lymph nodes, and none of the patients presented with retropharyngeal abscesses during our study period.<sup>8</sup>

The incidence of peritonsillar abscess was low in our study due to our inclusion criteria of patients with microbiology results only. It was however noted that an older adolescent patient was affected which is consistent with the literature.<sup>2</sup> At our institution, most patients with peritonsillar abscesses are treated medically, and it is not routine to send off aspirates for microbiology in uncomplicated cases. It is therefore estimated that the true incidence of peritonsillar abscess in the adolescent population is probably much higher.

Parotid space abscess affected 1% of pediatric patients<sup>8</sup>. However, in our study, 33% of adolescents presented with a parotid space abscess, one as a result of tuberculosis infection.

Microbiological studies of patients with deep neck space infections demonstrated that the main inciting organisms are bacterial in origin, but these bacteria may differ in pediatrics to those seen in the adult population.<sup>7</sup> This may be because adult deep neck space infections are generally due to dental pathology whereas pediatric deep neck space infections may be due to a spectrum of disease such as tonsillitis, pharyngitis, hematogenous spread and suppurative cervical lymphadenitis.<sup>14,15</sup> The microbiology of deep space neck infections continues to evolve. In 1983, Streptococci (61%) and *Staphylococcus* species (32%) comprised the majority of pure cultures in neck space infections, predominantly secondary to dental pathology<sup>6</sup>. Brook found that the most common isolates in paediatric head and neck infections are *Staphylococcus aureus* (aerobic) and *Bacteroides* species.<sup>5</sup> Other studies report that most common pathogens isolated in deep neck space infections include aerobes such as group A *Streptococcus* and *Staphylococcus aureus*.<sup>9</sup>

The results of our study are consistent with the literature, with *Streptococcal* and *Staphylococci* species being the most common isolates in the adolescent age-group. Adolescents in the school-age group are often candidates for *Streptococcus pyogenes* throat infections that may result in these patients being more prone to peritonsillar

abscesses. However, no *Streptococcus pyogenes* was identified in the peritonsillar abscess in our study.

Deep neck space infections are most often polymicrobial in adults, and these organisms reflect the microbial spectrum found in the oral cavity. The pathogens commonly isolated from pus cultures are group A *Streptococcus*, oropharyngeal anaerobic bacteria, and *S. aureus*.<sup>1,3,8</sup> Other pathogens may include *Haemophilus influenzae* and *Klebsiella pneumoniae* in diabetic patients.<sup>16</sup>

Preceding upper respiratory tract infection (56%) and dental infection (44%), were the leading causes of DNI in our study. This indicates that adolescent patients may present with a spectrum of pathology seen in both children and adults.

Limitations of this study include the fact that it is a retrospective analysis, small sample size due to the relatively low prevalence of this infection in the adolescent age group, and single-medical center data. Empirical antimicrobial coverage may have affected the microbiologic findings in those specimens which were culture negative. However, the characteristics of deep neck space infections in adolescent patients can still be identified from this study. The main causative pathogens from cultures, antimicrobial sensitivity and resistance patterns have also been identified.

### Conclusion

Deep neck space infections in adolescent patients should be diagnosed early and can often be successfully managed with medical therapy and surgical intervention when necessary. The spaces involved are similar to adults with 44% of patients having deep neck abscess secondary odontogenic infection. The microbiology however is similar to that of children with *Streptococcus* and *staphylococcus* species being the most predominant. The complication rate of DNI in adolescents is low.

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## Do the CPD questionnaire on page 501

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



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- 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.



# Dental educators' views and knowledge of competencies required within a competency framework

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## ABSTRACT

### Aims

The aim of the study was twofold; first was to explore and describe dental educators' views of the competencies required within the AfriMEDS core competency framework. The second was to highlight the views of the dental educators, regarding the alignment of the AfriMEDS core competencies, with the dental curriculum.

### Methods

A case study approach to qualitative inquiry was used. The participants were purposefully selected, and two focus group discussions were conducted. An interview protocol was used to guide the discussions. The gathered data from the discussions were transcribed verbatim, and uploaded to the Atlas ti program for data analysis. Themes were identified from the findings of the thematic analysis.

### Results

Dental educators required some guidance and clarity on the AfriMEDS core competency framework. However, they were able to recognize the competencies related to the AfriMEDS core competency framework. Two of these competencies, evidence-based dentistry, and private practice, were highlighted as core competencies in this current study; however, in AfriMEDS, only certain aspects of this was described.

### Conclusion

The results of this current study revealed that dental educators were able to make valuable recommendations about the additional competencies requirements for dental graduates.

## Keywords

Competency based education, Research Methodology Qualitative, Faculty Dental, Dental educators, competencies, competency framework, qualitative research.

## INTRODUCTION

Dental education in the twenty-first century is guided by societal and delivery changes, improvements in oral health, advances in science and technology, together with the complexity of the current evolving environment.<sup>1</sup> In addition to these changes, over the last decade, dental education has transitioned from traditional to competency-based education (CBE), with competencies requirements for dental graduates on graduation. In the past, educational practice has been to teach students increments of prescribed subject matter, the traditional curriculum, whereas the essence of CBE is that the success of dental, or allied health curricula should be judged in terms of its impact on students, expressed as competency outcomes.<sup>2</sup>

Competency is a complex behavior, or ability that is essential to initiate independent and unsupervised practice of a professional role, such as dentistry.<sup>3</sup> It comprises an intertwined array of numerous components, namely, capacity to apply knowledge, experience, critical thinking capability, problem solving skills, ethical values, and the capacity to perform tasks in accordance with established criteria.<sup>3</sup> Globally, competencies for dental graduates have been described in literature.<sup>4,5,6</sup> The American Dental Education Association (ADEA) approved the following competencies for the new general dentist: 1) critical thinking, 2) professionalism, 3) communication and interpersonal skills, 4) health promotion, 5) practice management and informatics, 6) patient care. A (assessment, diagnosis and treatment planning) and patient care B (establishment and maintenance of oral health).<sup>5</sup> Similarly, the majority of Canadian dental programs adopted a national consensus document, specifying competencies for a beginning dental practitioner in 1994.<sup>6</sup> This document comprises 47 competency statements. Canadian dental programs have used these competencies to guide the curriculum content, as well as provide evidence of curriculum outcomes.<sup>6</sup>

To ensure the provision of high-quality oral healthcare, it is essential to equip dentists with the competencies to cope with the challenges of every day dental practice. The University of Texas Health Sciences Center at San Antonio, involved their faculty, students, alumni, and outside consultants to re-evaluate the competencies

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### The role played and the respective contribution:

1. **Ronel D Maart:** Principle author 50%
2. **Razia Z Adam :** Co-author 25%
3. **Jose M Frantz :** Co-author 25%

of their program, to ensure they were contemporary, and the methods used to assess them, were valid and reliable.<sup>7</sup> As dental educators have the responsibility of synchronizing the undergraduate dental education with the clinical reality,<sup>8</sup> the assumption is that they would be ideally suited to provide input regarding dental graduates' competencies. Gaps in dental education have been identified from the perspectives of students, alumni, faculty members, employers, and patients.<sup>7</sup>

Various core competency frameworks inform dental curricula for dental schools, globally, and in South Africa, the African Medical Education Directions for Specialists (AfriMEDS) guides the dental curricula for all the dental schools in the country. The AfriMEDS framework also guides the accreditation process of all medical and dental schools in South Africa.<sup>9</sup> AfriMEDS was adapted from the Canadian Medical Educational Directives for Specialists (CanMEDS).<sup>9</sup> The reason for this adoption, and supplementary modification, was to align the framework in the South African and the wider African context, and to be sufficiently generic, to guide the training of all health professionals. AfriMEDS core competencies framework is related to the following seven roles: Health Professional, Communicator, Collaborator, Health Advocate, Professional, Scholar and Leader and Manager.<sup>10</sup>

The Global Oral Health Interest Group of the Consortium of Universities for Global Health initiated recommendations for core competencies in the education of health care professionals, and specific groups of the public, relevant to oral health.<sup>11</sup> This process recognized the lack of consensus on global oral health competencies, as a major disparity in the education of health professionals. Improvement needs that were identified by stakeholders, namely, students and faculty, are of particular value, as they are based on personal and direct experiences of successful, or unsuccessful outcomes, which could be used as a road map for curricular changes.<sup>12</sup>

As stakeholders, dental educators in South African dental schools are expected to map the dental graduates' competencies throughout the undergraduate dental curricula, for the accreditation process. In addition to this, the scope of the dental educators, includes teaching, assessment, and clinical supervision of undergraduate dental students, as well as contributing to this accreditation process, with the guidance of, inter alia, deans and committees. Additionally, changes associated with practicing dentistry in the 21st century, which explore competencies required for dental graduates, specific to the unique context of the graduates' practice, seems appropriate. Many studies on perceptions, including evaluations, of dental education have focused on student views, especially regarding curriculum content, delivery (teaching) and learning.<sup>12</sup> However, the views of dental educators, regarding the competencies of dental graduates, are equally important. In addition, published literature, on the core competencies required upon graduation of dental graduates in South Africa, is non-existent. Therefore, in this current study, the researchers aimed to explore and describe the dental educators' views of competencies required, in the AfriMEDS core competency framework. In addition, the aim was to highlight the views of the dental educators, regarding the alignment of the AfriMEDS core competencies, with the institutions' undergraduate dental curriculum.

## MATERIAL AND METHODS

A case study approach to qualitative inquiry was used in this study.<sup>13</sup> This allowed the researchers to explore the dental educators' views of the core competencies required, in the AfriMEDS framework for dental graduates. The population for this current study was dental educators from one of the universities in South Africa. The participants were purposefully selected, and included dental educators, who were module coordinators of clinical modules. This sampling was an attempt to provide cases, relevant to the research question, which were rich in information, and would provide in-depth insight.<sup>14</sup> Dental educators are responsible for teaching, learning, as well as clinical teaching of undergraduate dental students. The population comprised, approximately, 60 dental educators, of whom 14 (2 groups of 7) were purposively selected to represent the 7 clinical disciplines at this institution, using the following criteria: They had to be full-time dental educators, with a dentistry degree; and they had to be module coordinators of clinical disciplines (Clinical Dentistry, Conservative dentistry, Prosthetics, Maxillo-facial surgery, Paediatric dentistry, Orthodontics, Oral Medicine and Periodontology), from the second, third, fourth and final year of the respective courses.

The university Dentistry Calendar 2019 was used to access all the clinical modules offered in the undergraduate curriculum, and invitation emails were sent to these module coordinators. Two dates were set, and the selected participants' engagement were scheduled for dates that best suit them. Focus group discussions, as the data collection method of choice, were conducted in English with two groups of seven full-time dental educators. A semi-structured interview guide was used for the focus group discussions and, with permission from the participants, the focus group discussions were audio-recorded.

The primary researcher conducted the focus group discussions. Each participant was assigned a number from one to seven, and were instructed to refer to this number, when they responded during the discussion. At the start of the discussions, the primary researcher was introduced, as well as the research assistant, and the participants, before the focus group discussion-process/procedure was outlined. Both focus group discussions were recorded by means of a voice recorder, while the research assistant recorded field notes. An independent transcriber was used to transcribe the data of both focus group discussions. The transcriptions of both focus group discussions were uploaded on the Atlas ti computer program for data analysis. After the transcriptions were read and re-read, codes were assigned, based on the literature, and the use of descriptive words, or phrases. This data analysis was an iterative process. Subsequently, code groups were generated by categorizing similar codes that displayed interrelationships.<sup>13</sup>

Ethics clearance to conduct this current study was obtained from the Biomedical Research Ethics Committee at the University (BM 19/1/23). Before each focus group discussion, information sheets, outlining the aim of the study, were emailed to all the participants. In addition, consent forms were emailed to the participants, while confidentiality was

Table 1: Competency themes, categories and quotes from focus group participants.

Major Competency theme	Categories	Quotes from participants
1. Defining clinical competence	1.1. Clinical competence includes assessment, diagnosis and treatment plan	"Able to gather clinical data and to use that data to render a diagnosis and from that diagnosis to be able to develop a treatment plan and so that is a competency that we strive for and when we say develop a treatment plan." 1FG5
	1.2. Clinical competence requires a holistic and collaborative approach	"That we try or we tell our students that you must look at it holistically and not just look at the tooth that we treating in the clinic or the denture you making." 1FG7
2. 'Soft skills'	2.1. Professional competence	"Build some soft skills into the course as well. Communication and professionalism are two that fall under soft skills." 1FG4
	2.2. Communication	
3. Ethics Competence	3.1. Aspects of ethics should be specifically listed and identified as competencies	"The ethical components... we do have courses. We touch on it early in the years but it is actually, how can I say, we don't make enough about it, especially when they go out there. Soft skills, I think the ethics is also important and we should also be included with competence and it may be an attribute but it is also a competency" 1FG6
	3.2. Ethics to be integral part of the learning of all competencies and should be specifically assessed.	"I am not sure if they assess on ethics in the first and second year I have done it for the last three years so that we have an ethics lecture in our course so it is supposed to pull first and second year together but they are not assessed. So every year they must hear something about ethics and maybe that gets embedded in their mind, that as an attribute." 1FG4
4. Private Practice Competence	1.1 Business and leadership skills	"Private practice and the business skill. It is a skill or competency." 2FG6  "Entrepreneurial desire and skills to step up on their own." 2FG5  "Leadership skills, very important." 2FG5
	1.2 Entrepreneurial skills	

ensured. The signed consent forms were collected by the first researcher, at the start of each focus group discussion. The numbers that were assigned to the participants for the focus group discussions, ensured anonymity during the transcription and data analysis. The transcriptions were shared with the participants for member-checking, to ensure the trustworthiness of the data. During this process of generating codes and code groups, one of the research supervisors, cross-checked the codes and code groups, in a further effort to ensure trustworthiness and reliability. An external coder was employed as an additional trustworthy strategy. This external coding was completed, independent of the researcher's coding process. Themes were developed from the coding process, at which stage, the coding of the data from both focus group discussions were considered and reported on simultaneously.

## RESULTS

The responses from both focus group discussions were coded and analyzed together. In the first part of the results, the researchers endeavored to describe the findings of both focus group discussions, regarding the competencies, according to themes, which was followed by a discussion of the interrelated themes, and concluded with an interpretation of the meanings of the themes. In part two of the results, the participants' knowledge of the AfriMEDS core competency framework was outlined, as well as the alignment of the curriculum to it. The participant's

responses to the first question: "In your view, what are the competencies that the dental graduates require upon graduation or completion of their dental degree?" were arranged in major competency themes, categories, and relevant quotes from the participants (see Table 1). The findings of each of these major themes, namely, clinical competence, soft skills, ethics competence, and private practice competence, are discussed in the following section.

### Major theme 1: Clinical competence

The introductory comments of the participants revealed that clinical competence was regarded as the priority issue. There was no clear agreement as to what, specifically, this concept entailed; however, overall, it appeared to be regarded as an all-encompassing concept that included knowledge and skills needed/required for diagnosis and treatment. The following quotes outlined the general view of clinical competence:

*"Clinical competence is obviously one of the outcomes by the time they reach their final year and then obviously that builds into a lot of other competencies in their different disciplines, that you going to get to whatever specific to the discipline but essentially you want a clinically competent graduate that leaves from here" (1FG1)*

*"To treat a patient and do no harm and have enough knowledge to perform tasks that are allocated (2FG3)*

**Major theme 2: Soft skills: Communication and professionalism**

A few participants disclosed that communication was an inherent part of professionalism, and should be assessed as competence. Communication was highlighted as a competency required upon graduation, which is illustrated by the following quotes of the participants:

*“The ability to communicate with their community and with their patients” (2FG2)*

*“Learning sign language and learning how to communicate and that is a skill which I think will add competence for that special thing” (1FG6)*

Overall, the participants clearly expressed the need for clear descriptors of soft skill competencies, for the ability to assess the level of competencies. The following examples illustrated this sentiment:

*“In terms of professionalism, I think a lot more needs to be discussed around that because if you ask one person what professionalism means to him or her, you will find that people define that differently” (2FG1)*

*“We don’t have a uniform understanding of professionalism, then it is very difficult for us to say that this is the competency or the attribute that we want in our student because it would mean so many things”(2FG3)*

**Major theme 3: Ethics competence**

The participants’ discussions indicated that ethical behavior was a required competence; however, clear clarification of the aspects of professional ethical behavior, was not required to be able to assess it. The competence of identifying the basic human value of respect for the individuality and worth/dignity of every patient, was highlighted by some of the participants. Some relevant responses to ethics competence were recorded as follows:

*“You need to be professional and they need to be ethical in their behavior and their relationship with their patients and the community” (2FG7)*

*“Terms of ethics, my understanding of competency that we want to develop in terms of ethics is more of a framework in which they must conduct themselves to be ethical when they do their clinical work and I think that is important”(1FG5)*

**Major theme 4: Private practice competence**

The communication in the focus groups suggested overwhelming agreement on specific knowledge and skills as competencies to manage private practice. Remarkably, private practice competence was debated, extensively, during both focus group discussions. The specific skills mentioned, when starting a business included, how to construct a business plan, leadership skills, marketing, and financial issues, and managing staff. The following excerpts illustrated this:

*“They (students) said ‘you guys never prepared us for private practice’. I think then we are falling short because there is a competency that we need to measure or that we have to create or think about.” (2FG3)*

*“Private practice and how to manage a business and how to manage staff” (2FG6)*

In addition to the major themes identified and described (see Table 1), the participants highlighted competencies, which they considered important for dental graduates. These competencies, with their relevant quotes, are displayed in Table 2.

**Interrelating themes**

For the second layer of analysis, interrelating themes were developed. The HPCSA core competency framework, outlining the key competencies and enabling competencies,<sup>10</sup> were used as a guide (see Tables 1 and 2). These competencies, as described by the participants, were highlighted in the different interrelating themes or categories.

**Health care professional (HCP) / Clinical competence**

The clinical competence, identified by the participants, related to HCP competence. As outlined in the HPCSA’s core competency framework<sup>10</sup> “As health care practitioners,

**Table 2:** Competencies and quotes identified from focus group

Competency	Quotes
Collaborator	“Look at dental research, they work in groups so they collaborate with each other” 2FG4
	“To become critical citizens out there and to look to do better to the good of the community.” 2FG7
Digitally competency	“A competency to see our students to become technologically and digitally competent.” 2FG7
Life- long learner	‘I think it is to make sure our students are life- long learners and that they are able to upskill themselves no matter what they do.’ 1FG3
Evidence- based dentistry	“Evidence base, it is a big part of making critical or clinical decisions.” 1FG7
Internationalization	“Internationalisation as a competency, making these graduates attributes compatible into not just our society but with the international society.” 2FG6
Graduate Characteristics/attributes	“Trust and respect.” 2FG1
	“How do you make yourself flexible enough?” 2FG4
	“Attributes is like quality, like honest, being thankful, being charitable.” 2FG7



Table 3: Emergent concerns		
Emergent concerns	Categories	Quotes
Teaching and learning	Quotas	"I think quotas need to be discussed irrespective of competencies because how do we determine what is the correct number of quotas for a student to develop a particular competency and because we set quotas for the student, they don't necessarily engage their learning but they want to make sure that they fulfil the requirements of quotas"
	Curriculum changes	"Our curriculum must change, that is why we are struggling with competencies and getting students who are actually committed"
	Teaching approaches	"There is also the way that they approach their learning and we as educators must recognise that and we must see how we can adapt our teaching to engage them better"
School education		"So the student coming to us is used to not working on their own"
		"The way we were taught at school is totally different"
		"So the competencies that we now expect of our students has changed"
Alumni- feedback		"The context of Cape Town and South Africa and looking at our alumni there might be an alumnus that can aid us with curriculum development"
		"Practitioners today also need to come to the party and train and help and grow the young dentist that gets involves in practices"

healthcare professionals integrate all of the graduate attribute roles, applying profession-specific knowledge, clinical skills and professional attitudes in their provision of patient/client-centered care" (p .2). Ethics was also identified as a competency by a few participants. Acquiring the ethical, human rights, and legal principles embedded in healthcare, is one of the enabling competencies included in the role of HCP. Therefore, ethics is interrelated with a HCP and categorized under one theme. The participants shared that dental graduates should base their patient treatment on sound ethical principles. The teaching and the importance of ethics were discussed with the participants in the interviews. According to the findings, the participants expressed that graduates needed to view, as well as treat patients holistically. During the training of students, the ability for students to integrate across the various disciplines of dentistry is challenging, due to the strong discipline- or content-based training. The participants also strongly described record-keeping as a useful HCP competency, while graduate attributes were described as an enabling HCP competency, for example, to provide compassionate, empathetic and patient-centered care, to demonstrate insight into their own limitations of expertise, and to demonstrate a commitment to work in primary healthcare settings.

### Communicator

'As communicators, healthcare professionals effectively facilitate the carer-patient/carers-client relationship and the dynamic exchanges that occur before, during and after interventions' (p.5).<sup>10</sup> The participants referred to communication and professionalism as soft skills; however, it appeared as a separate core competency in the HPCSA Competency framework (p.5).<sup>10</sup> 'Establishing positive therapeutic relationships with patients and their families' is described as an enabling competency that could relate to the professionalism, or soft skills, referred to by the participants (p.25).<sup>10</sup> From the interviews, it was clear that communication was regarded as an important competency for graduates.

Some debate ensued about the teaching and assessment of communication, as well as whether they were appropriate and sufficient at the institution under scrutiny. Teaching of various communication skills, such as role-modelling, were discussed. Verbal and non-verbal communication skills are taught early in the dental undergraduate program; however, concern was raised about the assessment and importance of the integration throughout the senior clinical years. Additionally, communication with colleagues and peers was highlighted as an important skill. The teaching of an appropriate sign language was also suggested, to enable graduates to deal with the hearing-impaired patients.

### Collaborator

'As collaborators, healthcare professionals work effectively within a team to achieve optimal patient/client care' (p.7).<sup>10</sup> Reference was made to the manner in which students collaborate in groups for courses, such as dental research. There were limited discussions on collaboration, as a competency, as the participants reflected on the teaching of disciplines that occur in silos, referring to their own experiences, as teachers at the institution under scrutiny. Given the emergence and integration of inter-professional health education as a competency in dental education,<sup>15</sup> it was concerning that collaboration with the dental, or healthcare team was not discussed. This could have been influenced, in part, by the selection of the participants (module coordinators in clinical years) from the dentistry program only.

### Scholar

The participants highlighted critical thinking, evidence-based dentistry, and a life-long learner, as competencies. Collectively, these competencies relate to the role of a scholar of AfriMEDS. As outlined in the HPCSA's core competency framework, 'As scholars, healthcare professionals demonstrate a lifelong commitment to reflective learning as well as the creation, dissemination, application and translation of knowledge' (p.31).<sup>10</sup> Some of the descriptions of the enabling competencies of the role of a scholar, for example,

'...critical evaluation of health-related literature', relates well with the participants view (direct quotes) of critical thinking, as competency (p.32).<sup>10</sup> The participants considered evidence-based dentistry an important competency during the focus group discussions. Although evidence-based is not explicitly referred to in the HPCSA core competency framework, it is implied as an enabling competency, for example, '...critically appraise retrieved evidence for quality and relevance and interpret findings' (p.32).<sup>10</sup> According to Koole et al.,<sup>8</sup> evidence-based dentistry is a rather recent phenomenon in dental education. For this current study, it may have influenced some of the participants' translation of evidence-based dentistry, or its full potential as a competency. Consequently, the dentists in this current study may not have fully understood the concept, to value its full potential. Being a life-long learner was identified by the participants as a competency, which the dental graduate required. Lifelong learning is included in the core competency of a scholar as a lifelong commitment to reflective learning, and as an enabling competency, referred to as 'ongoing learning' (p.31).<sup>10</sup> Reference to upskilling was made, when the lifelong learning competency was discussed during the interviews.

#### Health advocate

As outlined in the HPCSA's core competency framework, 'As health advocates, healthcare professionals responsibly use their expertise and influence to advance the health and well-being of individuals, communities and populations' (p.10).<sup>10</sup> According to the findings, being a health advocate was viewed as a competency, which dental graduates should possess. Concern was raised about students not being exposed to real world circumstances in their communities. The participants perceived that dental students had been struggling to cope and manage their own health problems. Reference was made to substance abuse, as a coping mechanism. Being a health advocate, as a competency, was highlighted as an area of development for the curriculum.

#### Leader and manager

*Private practice* was highlighted as an important competency in the findings. This correlated well with the AfriMEDS's leader and manager role. As outlined in the HPCSA's core competency framework, 'As leaders and managers, healthcare practitioners are integral participants in healthcare organizations, organizing sustainable practices, making decisions about allocating resources, and contributing to the effectiveness of the healthcare system' (p.8).<sup>10</sup> Private practice was clearly identified as a competency that participants mentioned and discussed, in detail. Certain aspects, mentioned during the interviews, were business and management skills, which relate to the leader and manager core competency. The competencies highlighted by the participants, specifically referred to private practice competencies, such as setting up a private practice, financial planning, and human resource management/planning. Entrepreneurial skills were included in the private practice competency discussion. At the institution under scrutiny, the awareness and development of entrepreneurial skills were identified as areas of development for senior students, in recent years. The majority of the participants expressed their concern that the current curriculum did not prepare the dental graduates, adequately, for private practice. As there are limited public health positions available for

graduates after community services, private practice is where most of the graduates will practice.<sup>8</sup>

#### Professional

As outlined in the HPCSA's core competency framework, professionals, 'Demonstrate commitment and accountability to their patients/clients, other healthcare professions and society through ethical practice' (p.13).<sup>10</sup> According to the findings, professionalism was emphasized as a competency for all dental graduates. Some participants categorized it as a soft skill, and included professionalism and communication. It was evident that there was no common understanding of professionalism, including professionalism for students and staff.

#### Digital competence and internationalization

The importance of being digitally and technologically competent, was viewed as critical by the participants. They agreed that this should be included as a competence. As digital dentistry is one of the developmental areas, training becomes essential. Similarly, the participants viewed internationalization as an emergent competence. It was emphasized that dental graduates should be able to relate to our society, as well as the international society.

#### Emerging concerns

Besides highlighting the competencies for dental graduates, the participants were more concerned about the process of achieving the stated competencies. The following issues emerged: teaching and learning issues; high school education; and the value or influence of alumni from the dental faculty on the dental curriculum; which were debated, extensively, in both focus group discussions. Table 3 outlines the major views, as well as these emerging concerns.

Concerns and discussion about the strategies employed to teach students were shared. Suggestions about adapting strategies were centered on the millennials (also known as Generation Y, anyone born between 1981-1996), with the acknowledgement that they learnt differently, which emphasized the importance on adapting teaching and assessment approaches. It was clear that the focus group discussions provided a safe space for teachers to share their thoughts and offer suggestions. It was suggested that the faculty should create regular forums for teachers to share their experiences. Quotas, as indicated in Table 3 refers to number of clinical procedures required for clinical disciplines. This issue emerged prominently, and elicited an in-depth discussion. Disciplines vary regarding their clinical assessments, as well as the application of quantitative clinical requirements (quotas). For some disciplines, the quotas form a large proportion of the clinical progress of students. The participants were able to articulate the competencies required for the dental graduate; however, they were more concerned about how these competencies were being taught and assessed.

The participants were concerned about the school education's influence on the university student. Concerns were raised about the change of school curriculum, and its subsequent effects on teaching and learning at university level. The opinions raised related to the per-

ception of non-alignment between school and university. The participants concurred about the value of alumni feedback on the curriculum. The alumni of the dental school could provide essential information, regarding the strengths and weaknesses of the curriculum, which they had experienced.<sup>7</sup> However, the views, or input from the alumni of this particular dental school was not explored in the curriculum review, in the past, as well as the present. In addition, the participants explored the ways in which alumni could assist with assisting and preparing dental graduates for practice, specifically private practice. This could assist the university to prepare dental graduates for private practice, in the form of a mentorship-model.

#### **Alignment to AfriMEDS core competency framework**

When asked about the term, AfriMEDS, the participants were not familiar with the name; however, for some, CanMEDS was a familiar framework. However, the participants related well, and were familiar with the HPCSA-core competency framework. Details of the manner in which competencies relate to the undergraduate dental curriculum, were unclear to the participants; however, they were able to describe most competencies required by the HPCSA.

Interestingly, the responses to whether this dental curriculum was aligned with the AfriMEDS competency framework varied. Some were of the opinion that there was alignment, and that the undergraduate dental curriculum included most of the AfriMEDS competencies. Collaborator was highlighted, by some participants, as competency that was not aligned, suggesting that this be addressed in the current curriculum. Teaching, learning, and assessment of the competencies, professionalism, and communication, were viewed as necessary improvements in the faculty.

The participants indicated that, although some of the competencies were not included in the formal curriculum documents (e.g. Dentistry calendar), it was taught within the modules. As an example, one of the participants disclosed how communication was taught as part of one module in the clinical setting and classroom, although this competency was not included in the formal curriculum (dental calendar). In addition, one participant's view was that "we have a delusion on what we have", implying the appearance of a lack of transparency and coherency in the curriculum. As part of an institution, the required curriculum framework programs need to be aligned, creating some tension with the discipline-specific requirements, for example, the HPCSA requirements. Specific Graduate Attributes is regarded as one of the pillars of the institution's curriculum framework. The HPCSA core competency framework includes graduate attributes in the HCP competency, thus enabling the dental curriculum to interlace both requirements.

## **DISCUSSION**

In this current study, the researchers aimed to explore and describe dental educators' views of the competencies required in the AfriMEDS core competency framework, and its alignment with the undergraduate curriculum. The results of the focus group discussions indicated that dental educators required some guidance and clarity regarding the AfriMEDS core competency framework. However,

they were able to identify the competencies related to the AfriMEDS core competency framework, through their experiences and views. It became apparent that the current coursework taught in the various disciplines, were not always reflected in the formal curriculum. The discussions highlighted how most dental educators were strongly rooted in their specific disciplines, with a limited holistic view of the entire undergraduate dental curriculum, as well as the factors that guide the program. Dental educators' roles included: teaching and assessments in classrooms, as well as clinical settings; related administration; research; and dedicated departmental roles. Evidently, the dental educators were more concerned about the teaching and assessment of competencies, than the actual competencies. The results of a recent study highlighted that dental education endorsed learning domains as essential for the training of competent dentists; however, educators may experience difficulty with defining and assessing student outcomes in these areas.<sup>16</sup> It could be argued that this probably stems from the dental educators' level of involvement in the accreditation and curriculum development processes. Depending on the organizational structure, which is the mechanism that coordinates and manages the academic agenda of the school, the dental educators' level of engagement of may vary.

Therefore, in this current study it appeared that dental educators' views were influenced by their exposure to, and experience of seeing the bigger picture of the complete curriculum. Kadagad et al.<sup>17</sup> suggests a focus group discussion, with graduates, students, faculty, and alumni, regarding their perceptions of the curriculum's strengths and weaknesses, as one way to understand and evaluate an existing curriculum. If they are solely focused on their specific discipline, it may limit their appreciation of viewing the dental graduate as ready, for independent practice in the 21st century.<sup>15</sup>

The competencies that were identified as required by dental graduates, were aligned with the AfriMEDS core competencies. Two of these competencies, namely, evidence-based dentistry, and private practice, were highlighted as core competencies in this current study; however, in AfriMEDS, only aspects of these are described. Similarly, the findings of a study conducted by Koole et al.<sup>8</sup> revealed that certain professional competences, namely, dental practice management, accountancy, and taxation or stress-management, may be under-exposed.

Digital competency and internationalization were additional competencies highlighted as required by dental graduates. Practicing dentistry in the 21st century, is strongly supported by digital dentistry, and rapid developing technology that would support the inclusion of digital competency into the dental curricula. Koole et al.<sup>8</sup> confirmed that, to maintain a high quality of dental care, a strategy should be developed, through which dental curricula would be benchmarked, continuously, against an evolving clinical reality.

## **CONCLUSION**

The findings from this study were able to explore and describe the dental educators' views of the competencies required within the AfriMEDS core competency

framework. In addition, the views of the dental educators' views regarding the alignment of the AfriMEDS core competencies with the institution's undergraduate curriculum varied. Dental educators were able to reflect on the dental curriculum, as well as make valuable recommendations about the inclusion, integration, teaching, and assessment of core competencies. These recommendations for the undergraduate dental curriculum, at this selected institution, included that the role of collaborator needed to be reviewed throughout the curriculum, while the teaching, learning, and assessment of the communication and professional competency, also needed to be reviewed. Future curriculum review processes, therefore, would need to be informed by the requirements of the HPCSA, as well as the institution's specific requirements, to achieve a coherent and integrated curriculum. In this current study, the researchers highlighted the importance of engaging all stakeholders, especially dental educators, in curriculum planning and accreditation processes. When curriculum changes are proposed, involvement is the key to success, and efforts should be aimed at including as many stakeholders as possible, at different levels.<sup>17</sup> This would facilitate more inclusive and consultative processes, as suggested in this current study that dental educators could provide valuable recommendations for additional competencies requirements.

#### Disclosure

The authors declare no conflict of interest.

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# What's new for the clinician – summaries of recently published papers (September 2021)

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Compiled and edited by V Yengopal

## 1. What are the determinants for increased caries risk among children?

Lopes-Gomes, R., Ramos-Jorge, M.L., Fernandes, I.B. et al. Untreated dental caries and visible plaque of mothers are not determinant for the incidence of caries in dentin among children: evidence from a 3-year prospective cohort study. *Clinical Oral Investigations* 2021; 25: 5431–5439

### INTRODUCTION

It is estimated that 621 million children throughout the world have untreated caries on primary teeth. 1 Early childhood caries (ECC), which affects preschool children, progresses rapidly and is associated with pain, difficulty chewing, weight loss, difficulty sleeping, altered behaviour, and a poorer quality of life for affected children and their families. Children with dental caries have greater treatment need, which is expensive and not readily accessible in most developing countries. In South Africa, ECC is a major public health problem with caries rates among children as high as 70% in some provinces.

While determinants that contribute to the initiation and progression of dental caries are complex and multifactorial, understanding their role is crucial for establishing appropriate prevention and management strategies. The determinants can be divided into biological, contextual/environmental, sociobehavioural/cultural and socioeconomic factors. Examples of biological determinants include host susceptibility and oral flora, and the contextual/environmental determinants include access to and utilization of dental healthcare services, oral health promotion programmes and fluoridation of water. Moreover, examples of sociobehavioural/cultural determinants regarding dental caries include dental hygiene practices, consumption of sugars, lifestyle habits such as alcohol consumption and tobacco use. Multiple individual, family, and community factors are recognised as exerting an influence on the risk of dental caries.

The mother's oral health status and behaviour is thought to be a key determinant in the dental caries experience of the child but the evidence for this is regarded as weak.

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Lopes-Gomes and colleagues from Brazil (2021)<sup>1</sup> reported on a study that sought to evaluate whether characteristics related to mother's oral health are associated with the incidence of caries in dentin in preschool children.

### MATERIALS AND METHODS

Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines were used to guide the reporting of this study. A 3-year cohort study was conducted with a sample of 158 preschool children. The participants were selected from a representative sample of children aged one to 3 years and their mothers. The sample size was calculated considering on a 95% confidence interval (CI), 80% power, 1:1 proportion of non-exposed (mothers without untreated dental caries) to exposed (mothers with untreated dental caries), and prevalence of the outcome in children of mothers with and without untreated dental caries of 72 and 48%, respectively. These parameters determined the need to examine 132 mother-child pairs. The sample size was increased by 20%, leading to a final sample of 158 mother-child pairs (79 in each group). The selection of participants for each group was randomised, using a list of exposed and non-exposed children based on baseline information.

Two examiners performed the clinical examinations under artificial light following prophylaxis and drying of the teeth with compressed air. The examiners had previously undergone training and calibration exercises for the detection of dental caries using the International Caries Detection and Assessment System (ICDAS). The clinical examinations of the children were performed in a dental chair under artificial light with the aid of a mouth mirror and WHO probe. Visible plaque on the maxillary and mandibular incisors was evaluated after drying the teeth with compressed air. The possibilities for the outcome of this examination at follow-up compared to baseline were (1) remained without plaque, (2) reduction in the number of teeth with plaque, (3) maintenance of the same number of teeth with plaque, and (4) increase in the number of teeth with plaque.

The evaluation of dental caries was performed after prophylaxis and drying of the teeth. The detection of caries and its activity was performed using the ICDAS criteria. Tooth surfaces were classified as sound (code 0), initial caries (codes 1 and 2), enamel caries (codes 3 and 4), or dentin caries (codes 5 and 6).

Caries in enamel was classified as active when the enamel surface was whitish, rough, and opaque (not glossy). Caries in enamel was classified as inactive when the lesion was whitish or darkened, glossy, and had a hard, smooth consistency when the tip of the probe was moved lightly across the surface. Caries in dentin was classified as active when the surface had a soft consistency upon careful probing.

The incidence of caries in dentin at follow-up was investigated by comparing the data collected at baseline for the determination of new caries in dentin, independently of whether it was a tooth that was already present in the baseline or that erupted between the baseline and the follow-up. The examiner at the follow-up evaluation had no knowledge of the baseline findings. The charts were stapled after the second examination by a member of the research team.

Caries experience in the mothers was determined using the criteria established by the World Health Organization (WHO). The examinations were performed in a dental chair under artificial light with the aid of a mouth mirror and WHO probe by a third examiner who had undergone training and calibration exercises. The possibilities for the outcome of this examination at follow-up compared to baseline were (1) remained without untreated caries, (2) reduction in the number of teeth with untreated caries, (3) maintenance of the same number of teeth with untreated caries, and (4) increase in the number of teeth with untreated caries. Visible dental plaque in the mothers was investigated by a visual inspection after drying the teeth. The possibilities for the outcome of this examination at follow-up compared to baseline were the same as those described for the children. The mothers were also asked to fill out a questionnaire addressing the child's sex and age as well as socioeconomic and demographic data of the family, such as mother's education (< or  $\geq$  9 years of study), family income ( $\geq$  or < two times the monthly minimum wage in that setting), and number of children (one or  $\geq$  two). The terms "high" and "low" were employed to facilitate the description of the data. For example, low mother's education was less than 9 years of study and high mother's education was nine or more years of study. The possibilities for mother's education and family income at baseline and follow-up were low-low, low-high, high-low, and high-high. The mothers were also asked to fill out a dietary log for three consecutive days recording the children's food intake. This log was used to calculate the mean daily intake of snacks containing sugar between main meals. Sugar intake  $\leq$  twice a day was considered low and intake > twice a day was considered high.

## RESULTS

A total of 137 children (67 in the exposed group and 70 in the non-exposed group) and their mothers participated through to the end of the study, corresponding to an 86.7% response rate. The main reason for dropouts was the

absence of the child on the day scheduled for the follow-up evaluation.

At follow-up, mean age of the children was 62.6 months ( $\pm$  11.6) and girls accounted for 51.4% of the sample. The majority of the mothers (52.5%) had low education at both baseline and follow-up. Family income was higher than two times the monthly minimum wage among 44.5% of the sample at both evaluations. Regarding mother's oral health status, 16.1% had the same number of untreated caries at baseline and follow-up and 16.8% exhibited an increase in the number of untreated caries between the two evaluations. The number of teeth with visible plaque increased among 31.4% of the mothers.

Sixty children (43.8%) exhibited new caries in dentin at the 3-year follow-up evaluation compared to baseline and the incidence of caries was more frequent in the exposed group. A total of 52.2% of the 67 exposed children and 35.7% of the 70 non-exposed children exhibited new caries in dentin at follow-up.

The frequency of new caries in dentin was greater among children whose mothers maintained a low level of education (59.7%) and low income (69.2%) as well as those from families in which the income diminished between the two evaluations (57.7%). The same was found for children whose mothers maintained the same number of teeth with untreated caries (61.2%) as well as those who either maintained (73.9%) or experienced an increase (60.5%) in the number of teeth with visible plaque. Regarding the children's sugar intake, the frequency of new caries in dentin was lower among those who reduced their intake (19.2%). Children who maintained the same number of teeth with visible plaque had a greater frequency of new caries in dentin (62.1%). Those who experienced an increase in the number of teeth with visible plaque also had a greater frequency of new caries in dentin (50%). The frequency of new caries in dentin was greater among those who had active caries at baseline (61.9%) and those who had caries in dentin at baseline (77.1%).

The unadjusted analysis revealed that mother's education, family income, number of mother's teeth with untreated caries, number of mother's teeth with visible plaque, child's sugar intake, number of child's teeth with visible plaque, active caries at baseline, and caries in dentin at baseline were risk factors for the development of new caries in dentin among the children. In the final model, the maintenance of low mother's education (RR 1.54; 95% CI 1.03 to 2.38), the maintenance of low family income (RR 2.05; 95% CI 1.29 to 3.26), the reduction in family income (RR 2.49; 95% CI 1.62 to 3.83), the increase in the frequency of daily sugar intake (RR 1.67; 95% CI 1.09 to 2.52), the maintenance of high sugar intake (RR 1.81; 95% CI 1.14 to 2.87), and the occurrence of caries in dentin at baseline (RR 1.53; 95% CI 1.19 to 1.97) were risk factors for the incidence of caries in dentin.

## CONCLUSIONS

The authors reported that untreated dental caries and visible plaque were not associated with increased incidence of caries in dentin among the children. However, low mother's education (less than 9 years of study), a low



family income or reduction in income, high daily sugar intake, and a history of caries in dentin were risk factors for the incidence of caries in dentin in the 3-year follow-up period. Children with experience of caries in dentin in early childhood have an approximately twofold greater risk of developing future caries in dentin.

### Implications of practice

The socio-economic status of the mother and her educational level are key determinants for increased caries

risk among children. Oral Health education of the mothers and a change of behaviour will have significant benefits for both the oral health status of mother and child.

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## 2. Do preoperative glycosylated hemoglobin (HbA1C) and random blood glucose levels predict wound healing complications following exodontia in type 2 diabetes mellitus patients?

Krishnan B, Prasad GA, Saravanan R, Madhan B, Kadiravan T. Do preoperative glycosylated hemoglobin (HbA1C) and random blood glucose levels predict wound healing complications following exodontia in type 2 diabetes mellitus patients?—a prospective observational study. *Clinical Oral Investigations*. 2021; 25:179-85.

### INTRODUCTION

Diabetes is one of the most prevalent non-communicable diseases. In 2020, the International Diabetes Federations reported that approximately 4 581 200 million adults in South Africa have diabetes. Diabetes mellitus (DM) DM may be diagnosed based on glycosylated hemoglobin criteria (HbA1C) or plasma glucose criteria (fasting blood glucose (FBG) or 2-h postprandial after a 75-g oral glucose tolerance test (PPBG)). A HbA1c of  $\geq 6.5$ , FBS  $\geq 126$  mg/dl (7 mmol/l), PPBG  $\geq 200$  mg/dl (11 mmol/l) is considered diagnostic for DM. A random blood glucose (RBG) level  $\geq 200$  mg/dl in patients with classic symptoms of hyperglycemia may also be indicative of DM.<sup>1</sup>

There appears to be evidence to strongly suggest an association between DM and surgical site infections (SSI) and individuals with uncontrolled DM show a predilection to increased severity of morbidity and frequency of mortality.<sup>1</sup> The type 2 diabetic patient undergoing exodontia/extraction is also believed to be at a higher risk for wound healing complications and surgical site infections. This belief often leads many dentists to prescribe pre- and postoperative antibiotics to minimize the risk of surgical site infections, even though there is little evidence to support this practice.<sup>1</sup> Krishnan and colleagues in India (2021)<sup>1</sup> reported on a trial that sought to analyze if preoperative HbA1C and Random Blood Glucose (RBG) testing could predict the risk of wound healing and infectious complications in type 2 DM patients undergoing exodontia/extractions in an office setting.

### MATERIALS AND METHODS

This prospective observational study was conducted over a 15-month period (July 2017 to October 2018), in the dentistry outpatient clinic of a Public Sector Teaching Hospital in India.

There were 2 study groups. Group A included 133 patients, irrespective of gender and above the age of 35, with a history of type 2 DM for at least 1-year duration and needing exodontia. These included patients on oral hypoglycemics, insulin, or both. Group B consisted of age- and gender-matched non-diabetic 133 patients (control group) undergoing exodontia. HbA1C values and preoperative RBG levels were obtained for patients in both groups. Patients with conditions that predispose to delayed wound healing (immunodeficiency, malignancy, steroid use), co-existing local or systemic infections with recent antibiotic use, and pregnancy were excluded. Data collected included parameters such as duration of DM and type of medication used, the number of teeth extracted and reason for extraction, and habits such as smoking and alcoholism. All patients underwent exodontia/ extraction under local anaesthesia (2% lignocaine with 1:200,000 adrenaline) by surgical residents in the outpatient clinics. Patients in both groups received similar instructions on post-surgical wound care, prescribed with analgesics, and offered a follow-up review between the 7th and 10th post-op day or return to the outpatient clinics if they had any problem. During this review, postoperative wound healing complications included (a) non-infectious (alveolar osteitis, excess or unhealthy granulation tissue with sequestra in extraction sockets), (b) infectious complications (local or systemic) and (c) additional procedures and medications provided were recorded by a faculty/senior resident. Patients who did not report for the follow-up review were deemed to have had uncomplicated healing.

### RESULTS

The duration of diabetes among the participants ranged from 1 to 25 years with a mean of  $6.9 \pm 4.5$  years. 80.5% of diabetics were treated with oral hypoglycemics, while 14% were on a combination of oral hypoglycemics and insulin. A vast majority of patients in both groups underwent extraction of only a single tooth. In both

groups, about 10% of extractions required a transalveolar method. The diabetic group had more smokers (19.5%) in comparison to the control group (7.5%). There was no significant difference in non-infectious complications between the two groups. The absolute risk of infectious complications in diabetics was 10.5% compared to a 6.8% risk among the control group (95% CI). However, this excess infection risk was not statistically significant. Among the diabetics who developed infectious complications, the Random Blood Glucose (RBG) and HbA1C values were elevated, but were not statistically significant. In both groups, infectious complications were managed with intraoral surgical drainage and/or oral antibiotics and no patient needed hospitalization and intravenous antibiotics. Age, RBG values, HbA1C, duration of DM, and number and nature of exodontia performed did not show any statistical significance in the logistic regression model.

## CONCLUSIONS

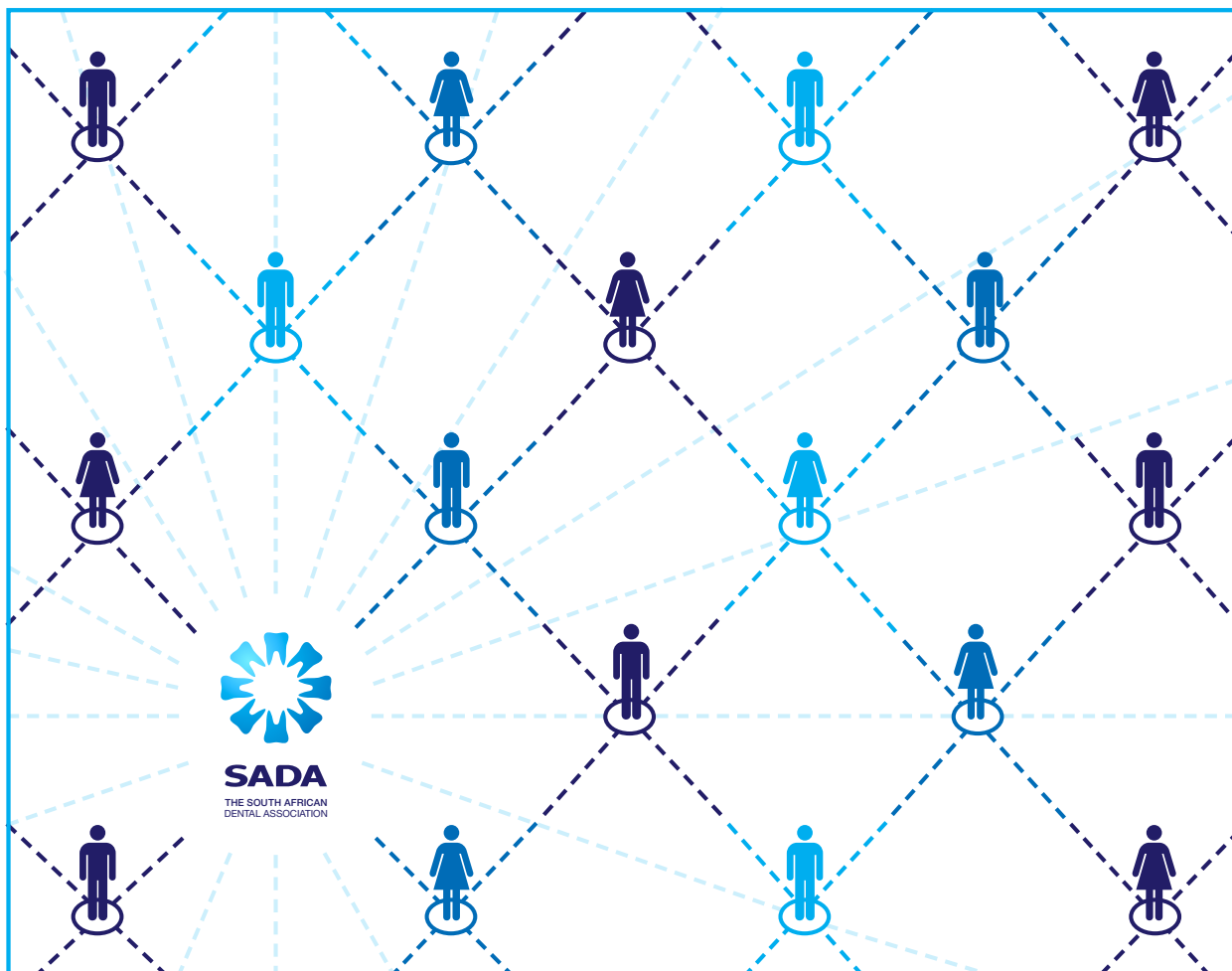
This study observed a slight, but not statistically significant increase in the risk of infectious complications in type 2 DM patients undergoing exodontia/extraction. Surgical site infections were amenable to surgical drainage with or without oral antibiotics on an outpatient basis with favourable healing outcomes.

## Implications for practice

The Random Blood Glucose (RBG) and HbA1C values were not significantly associated with risk of infectious complications. Resorting to prophylactic antibiotics and warning about possible adverse healing for routine exodontia in type 2 DM patients is unnecessary.

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# Maxillofacial Radiology 193

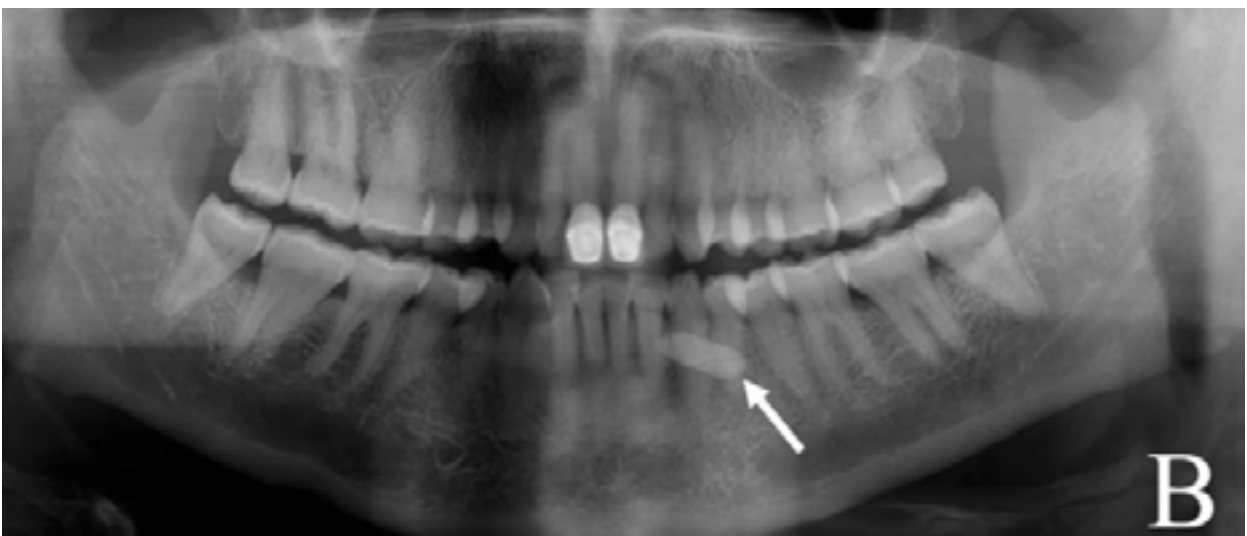
## Bridging analogue and digital imaging in occlusal radiography

SADJ September 2021, Vol. 76 No. 8 p496 - p497

C. Nel<sup>1</sup>, Z. Yakoob<sup>2</sup>

### CASES

Two patients presented with incidental findings of well-defined radiopacities located in the mandible (Figure 1A & B).



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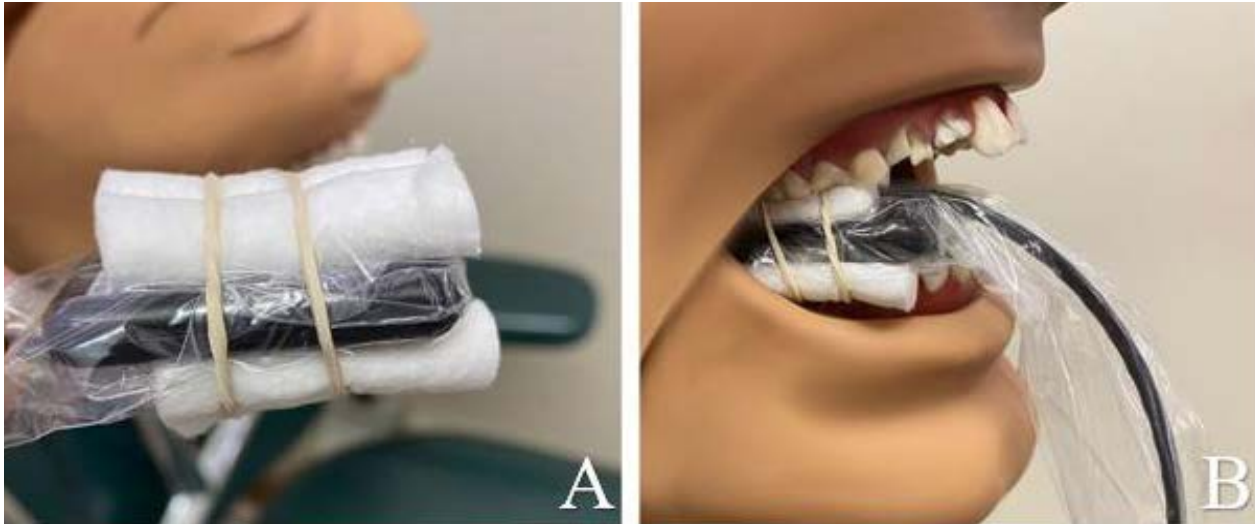
1. Chané Nel: Primary author - 70%
2. Zarah Yakoob: Second author - 30%

### INTERPRETATION

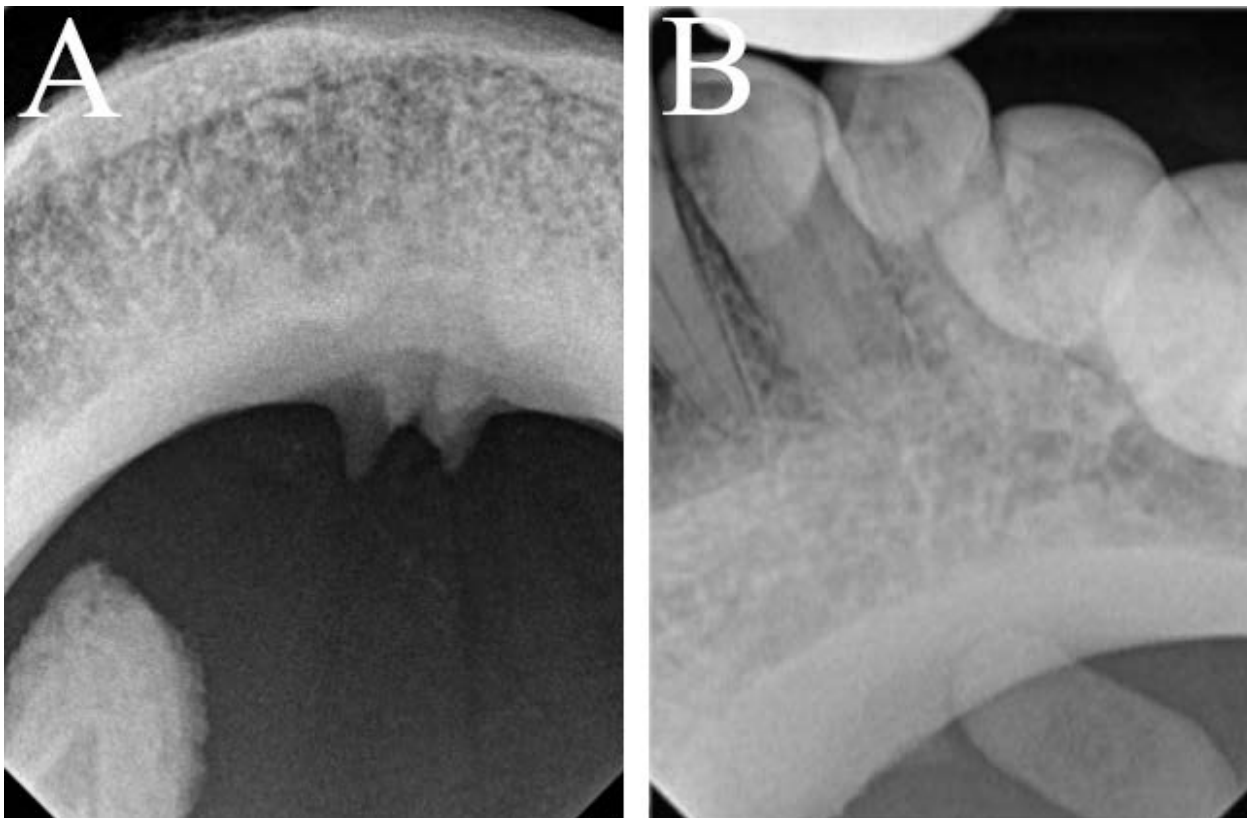
When radiopacities are detected in the mandible it is imperative to establish whether they are centrally (within or attached to the bone) or peripherally (in the soft tissues) located. The establishment of locality aids in the development a differential diagnosis.

Two low-dose intraoral methods can be used in this regard, namely the buccal object-rule and mandibular occlusal radiographs. In the golden age of film and the more modern photostimulable phosphor plates, the process of acquiring an occlusal radiograph is typically straightforward. However, this process is difficult with the more commonly used charged coupled device (CCD) or complementary metal-oxide semiconductor (CMOS) digital sensors. An alternative method may be used to secure the sensor with two dental disposable cotton rolls at the top and bottom, held in place with an elastic band.

The exposure side of the sensor is then positioned against the segment of the jaw in the region of interest (Figure 2A & B).



Using this method it was established that the radiopacities of both cases were located peripherally in the soft tissues, supporting a diagnosis of sialoliths (Figure 3A & B).



Salivary gland stones, better termed sialoliths, occur due to deposition of calcium salts around a central nidus of bacteria or debris. Their formation can be enhanced by xerostomia or chronic sialadenitis. Sialoliths most frequently occur in the submandibular gland followed by the parotid. The predilection for the submandibular gland is due to the thicker mucinous secretions produced by the gland and the long torturous path of Wharton's duct.<sup>1</sup> Clinically, patients may experience swelling and intermittent pain around mealtimes. Panoramic radiography usually highlights oval or elongated radiopacities superimposed over the mandible.<sup>2</sup> Imaging from another angle is needed for final confirmation of the diagnostic hypothesis. The treatment consists of surgical removal of the sialolith with repair of the associated duct.<sup>1</sup>

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# Grillz and Gold Teeth – Esthetic, Economics and Ethics

SADJ September 2021, Vol. 76 No. 8 p498 - p500

TM Mtolo<sup>1</sup>, PD Motloba<sup>2</sup>

## Case report: Anecdote from dental technician

My laboratory has been providing services to a modest number of dental professionals for a while now. As part of prosthodontic work I have done, one has witnessed a generalised upsurge, albeit steady, in the request for gold inlays, followed by silver and grills overtime. The demand for these services is correlated with the location, period and ethos of the practice. Our practice has seen a drastic tapering down of requests during the Covid -19 period. Ultimately, there is a discernable driver for the demand of these services. We have also observed from dental casts that, the dentition appeared to be without any noticeable pathology. This implies that most patients requiring these prosthesis, have “virgin” teeth prepared.

Being a small laboratory, our numbers, are insignificant compared to bigger laboratories. Additionally, unregistered laboratories and jewellers have entered this space and are providing ‘affordable’ alternatives. On a typical month, our laboratory fabricates a total of 320 prosthesis of which gold inlays, constitute about 60%, silver, 30% and grills, 10%. These numbers are an under-representation of the extent of this phenomenon and the potential ‘subdued’ and untapped market, especially during this fierce Covid -19 economic downturn.

We hypothesise that we are witnessing the tip of an iceberg, and that under the right conditions, this grills and gold teeth epidemic will go beyond the tipping point. Given the cultural, economic and other factors, more and more youth will sustain the demand for these services in perpetuity.

## Dental adornment – evolution

Human interpretation and understanding of ‘looks’ has at best been controversial or emotive. The ugly truth is that looks are for some, everything; for some, looks are important but not everything. However this matter is diced, appearance have always mattered since time in memorial

and continues throughout civilization. There is nothing vain about how one looks, or how one wants to presents themselves to the world. People have throughout history chosen to embellish, decorate and beautify themselves with personal adornments, in order to present the best version of themselves to the unforgiving world. Jewelry, cosmetics or makeup and associated items continue to be used for this purpose.

Nowadays dental health and appearance has found expressions from those who want to be seen and appreciated. The demand for elective aesthetic procedures, such as braces, teeth whitening, crowns, and bridges is on the rise. Dental adornment is not new, but represent a reimagining of old traditions spanning back many centuries. Modern grillz and ‘quintessential’ pirate gold teeth have appeared, disappeared and reappeared in bursts and spouts, as civilization evolved. This modern expression of dental ‘aesthetics’ embodies the insatiable human desire to change their appearance including modifying their teeth.

## Resurgence of the Grillz and gold teeth - revolution

Grillz are wearables that snap over the wearers teeth. Grills are made of gold, silver or other metals which are encrusted with jewels at the pleasures of the wearers.<sup>1</sup> Mouth bling was first recorded in 800 BC – 200 BC among the Etruscans in Italy. Rich Etruscans women wore decorative gold teeth, or teeth carved out of ivory and reused teeth among a plethora of dental adornments.<sup>2</sup> Mayans are known to have used well carved stones to prepare the labial surfaces of anterior teeth.<sup>3</sup> Meticulous fillings and inlays or a combination were then placed on these teeth according to tribe and regions. These forms of dental mutilation were done of maxilla anterior teeth for religious as well as aesthetic reasons.

The 1980s saw a major resurgence of grills and gold inlays as symbols of wealth and status. Grills or bling represented a fresh and unique expression of the cutting-edge hip-hop culture, much more than mere costume jewelry of the time.<sup>4,5</sup> Recently, various artists have reinvigorated and garnered interests in grills. Nelly in his number one hit ‘Grills’ in 2005 and Kanye West’s revelation of his diamond encrusted mandibular grill, in Ellen DeGeneres in 2010, catapulted the grills culture into hip pop spotlight.<sup>6</sup> The popular singer Rihanna, also displayed her removable gold grills in 2011 for her “You Da One” music video. These adornments do not come cheap, for example Lil Wayne bejeweled smile cost him over \$150,000, and Birdman around \$500,000.<sup>7</sup>

Cosmetic dentistry has not only been the preserve of the rich and powerful. Vikings, the Scandinavian’s most celebrated traders, explorers and warriors, took pride in their appearance and modified their teeth as a mark of achieve-

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ment among the warriors.<sup>8</sup> Similarly gold teeth have been associated with the villain character of 'pirate's desire for wealth, greed, and ostentation. This portrayal of conspicuous wealth is more fiction than reality.

### Cosmetic or Aesthetic Dentistry – Matter of semantics

These days many people do not necessarily opt for grillz or gold teeth, but rather opt for 'cosmetic' or aesthetic dentistry' to improve their general dental appearance. These procedures are undertaken to restore stained, discolored, chipped teeth, malocclusion and many more dental problems.<sup>9</sup> As 'smile makeover' procedures, these procedures are often times undertaken on healthy teeth, just for the recipient to feel good about themselves.<sup>10</sup> Some clinicians have lamented the usurping of 'need-based' dentistry by the 'want-based' dentistry camouflaged as cosmetic or aesthetic dentistry. Whether this phenomenon is driven by culture or cash.<sup>11,12</sup> Either way, the implications can have far-reaching consequences for the profession and population.

The terms cosmetic and aesthetic dentistry are used interchangeably, despite their critical differences and application. By definition, cosmetic dentistry refers to provision of dental decoration or adornments meant to make the patient present better, more beautiful, or more impressive.<sup>13</sup> These procedures are mere top-ups or additions to the existing dentition. They are reversible, do not cause lasting change or damage to dentitions and supporting tissues, neither do they improve function.

Aesthetics dentistry, is a "branch of philosophy dealing with beauty", which is challenging to conceptualise and execute in dental practice. The goal of aesthetic dentistry is to give the patient a natural look, resulting in an improvised and seamless transformation, while maintaining functional integrity. Aesthetic dentistry, also referred to as biomimetic dentistry or biomimetic procedures, 'recreates nature at its finest' by offering undetectable transformation, aimed at making the patients better than well. The complexity of aesthetic dentistry requires cooperation and excellence of multidisciplinary team, and most critically, patient participation. A plethora of dental procedures are offered as part of aesthetic dentistry, for example, crown and bridgework, orthodontic treatment, implants, periodontal surgery and orthognathic surgery. Notwithstanding these differences, dentists continue to provide a myriad of elective procedures, attributable to increasing patient's requests. The central questions about aesthetic dentistry is whether the procedures confer beauty, excellence or desirable and for whom? Beauty is always in the eyes of the beholder, the patient, society of the clinician.

### Ethical Implications

Professional codes of conduct, moral and ethical principles provide guidance for clinical decision making by practitioners. Arising therefrom, the clinician is obligated to (i) provide timely, appropriate and safe dental care to the patients (beneficence); (ii) refrain from causing unnecessary harm to patients (non-maleficence); (iii) involve and respect of patient's needs and expectation throughout the course of clinical care (autonomy).<sup>14-16</sup> Ultimately, a virtuous clinician will provide dental treatment aimed at achieving (i) greatest 'happiness' for the patient, by maximising utility or benefit over harm<sup>17</sup> and (ii), always consider patient's agency<sup>18</sup>. Failure to provide patient-centered, predictable,

safe, appropriate care is a blatant violation of ethical code of conduct and patient-dentist relationship.

Bader and Shugars<sup>19</sup> state, "*An implicit, if not explicit, assumption accompanying any treatment is that the benefits of the treatment will, or at least are likely to, outweigh any negative consequences of the treatment...in short, that treatment is better than no treatment.*"

The provision of grillz and gold inlays by dentists raises serious and interesting questions about this routine and 'socially' acceptable procedure. The ethical and moral dilemma arise as questions about aesthetics, ethics and economic collide. Whether this intervention necessarily proffer beauty, or result in economic and clinical harm to the patient is a matter is fierce contestation. Grillz and gold inlays may cause harm to patients, and simultaneously benefits the patients, and demonstrate respect for patient's wishes and preferences. Several arguments provide the pros and cons about grillz and gold inlays.

Anecdotally, dentists who oppose the provision of grillz and gold inlays argue that these procedures are akin to over-servicing or over-treatment. The contention is that the treatment is unnecessary, inappropriate and likely to cause harm than good. Furthermore, this treatment can be likened to dental mutilation, in which non-pathological, "virgin" teeth are tempered with and sound tooth structure is removed unnecessarily. These exposes patients to unknown risks of 'treatment'. Furthermore, there is limited evidence or research on the clinical efficacy and need for grillz and anterior gold restorations. Therefore, undertaking, irreversible procedures, using the restorative materials with untested, unproven clinical efficacy in the anterior region is analogous to clinical experimentation.<sup>20</sup>

The dentist has a duty to manage harmful and unrealistic patient's expectations. The provision of grillz and gold teeth, could indicate the failure of the clinician to obtain informed consent, properly counsel the patient and manage their expectations. Clinicians can be accused of undue influence or paternalism in favour of treatments that confer financial gains than clinical benefit. The advancement of commercial interests over clinical outcomes or economics over ethics pose a serious threat to patient-dentists relationship.<sup>12</sup>

The demand and financial incentives has spurred jewelers and unlicensed vendors provide grillz and gold teeth to the public without additional training that dentists possess. Proponents of grillz and gold teeth contend that dental professionals are best suited to service this market, failing which it will go deep underground. Understandably, qualified professionals are appurtenant to provide this service safely and with minimal harm. There is case to be made about the social and emotional utility of these prosthesis.

Grills or bling legitimizes one's social standing and confers social benefits. These personal adornments are portable wealth which could accentuates one's stature and position in the social pecking order. This trend will continue driven by hip hop culture and the need to belong. The dental professionals must confront this situation in order to minimise potential harm to patients.

## CONCLUSION

When faced with patients requiring dental enhancements like grillz or gold teeth, an encounter which occurs often in some communities in South Africa. The dentists must uphold and act in accordance to the principle of “primum non nocere” or first do no harm. In so doing the patient’s desire for adornment will be secondary to well-being, even at the expense of patient’s autonomy – justifiable paternalism. It is incumbent on dentists to consider undertaking those procedures with positive benefit risk ratio, and decline potentially harmful interventions. Dentists must desist from prioritizing personal economic gain over care and ethics. Any clinically unnecessary inappropriate treatment is over-servicing which is fraudulent larceny and constitutes unethical conduct and a breach of the profession code of conduct. It is incumbent on the profession to regulate and develop guidelines for the fabrication and placements of these prosthesis. The alternative will have grave consequences to the patients, as this phenomenon is here to stay. The financial incentives are too great for jewelers and vendors of these dental adornments to abdicate. At the clinical level, practioners must discourage wearing of grillz and gold teeth. In cases where patients have these prosthesis, dentists must encourage patients with grillz to engage in proper oral hygiene practices, use fluoride and reduce prolonged wear. The stakes have never been high, the economic impact of Covid-19, has heightened the tension between aesthetics, ethics and economic. It is hoped that this paper has succeeded in elucidating areas of tension and solutions in managing patients requiring grillz and gold teeth.

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# CPD questionnaire

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

## GENERAL

### Dental implant imaging: What do South African dentists and dental specialists prefer?

- Select the CORRECT answer: What was the most selected radiographic technique (or combination) by the surveyees during and directly after the implant surgery?
  - Panoramic radiograph (only).
  - Panoramic + Periapical radiograph.
  - Periapical radiograph (only).
  - Periapical radiograph + cone beam computed tomography (CBCT).
- Which of the following answers is CORRECT: What was the most preferred radiographic technique (by the surveyees) to be used during implant planning in the vicinity of mental foramen?
  - Panoramic radiograph + CBCT.
  - CBCT (only).
  - Panoramic radiograph + Periapical radiograph.
  - Panoramic radiography (only).
- Select the CORRECT option: The most indicated factor (by the surveyees) impacting the radiographic modality choice during the planning phase was:
  - Three-dimensional modalities provide more anatomical information necessary for the success of the therapy.
  - Better dimensional accuracy provided by three-dimensional modalities.
  - Broad coverage of the designated anatomical area.
  - Cost-related issues.
- Which of the following is CORRECT: What was the most preferred radiographic technique (or combination) to be used during implant planning in full mouth cases?
  - Panoramic radiograph + CBCT.
  - CBCT (only).
  - Panoramic radiograph + Periapical radiograph.
  - Panoramic radiography (only).

### Detrimental orofacial manifestation of dengue and dengue hemorrhagic fever- clinical case series, review of the causes, complications, and vaccine strategies: Dengue and Oral Manifestations

- Select the CORRECT answer: Which of the following is an oral manifestation of Dengue hemorrhagic fever?
  - Lingual hematoma.
  - Osteonecrosis of the dentoalveolar structure.
  - Gingival bleeding.
  - All of these.

- Select the CORRECT answer: Which amongst the following is the most severe form of dengue disease that cause hospitalization and death in Asia:
  - Dengue fever.
  - Dengue hemorrhagic fever.
  - Dengue shock syndrome.
  - None of these.
- Which of the following is CORRECT: Which of the following mosquito vectors is responsible for dengue fever:
  - Aedes albopictus.
  - Aedes aegypti.
  - Culex quinquefasciatus.
  - Wyeomyia smithii.

### Predictable sedation: Safe administration of oral Midazolam and nitrous oxide gas for paediatric patients in the general dental practice

- Select the INCORRECT drug: What drug regimen has NOT been successfully executed in the sedation of children in the dental clinic?
  - Nitrous oxide inhalation sedation with oxygen alone.
  - Midazolam alone.
  - A combination of both techniques.
  - Chloral hydrate.
- Select the CORRECT option: Nitrous oxide is:
  - Odorless and colorless gas.
  - Effective because it results in a pleasurable feeling, which in turn relaxes patients.
  - Fast acting.
  - Rapidly and effortlessly reversed.
  - All of the above.
- Select the INCORRECT answer: Behavioural management techniques employed on young children does NOT include:
  - Tell show and do.
  - Positive reinforcement.
  - Modeling.
  - Aversive technique.

### Deep neck space infections in Adolescents

- Select the CORRECT answer: What is the most common cause of deep neck space infections in adolescents (ADNI)? The advantages of vinegar include:
  - Tonsillitis.
  - Dental infections.
  - Foreign body ingestion.
  - Trauma.



12. Choose the CORRECT answer: What is the most common causative micro-organism in ADNI?
- Proteus mirabilis.
  - Streptococcus anginosus.
  - Streptococcus constellatus.
  - Staphylococcus aureus.
18. Koole *et al.* revealed that certain professional competences may be underexposed, namely:
- Dental practice management.
  - Accountancy.
  - Taxation or stress-management.
  - All of the above.

13. Which answer is CORRECT: What is the empiric antibiotic of choice of ADNI in the South African setting?
- Azithromycin.
  - Rifampicin.
  - Metronidazole.
  - Amoxicillin-clavulanic acid.

#### Clinicopathological evaluation of focal reactive lesions of the gingiva

14. Select the CORRECT answer: Which of the following is a focal reactive gingival lesion?
- Central ossifying fibroma.
  - Kaposi sarcoma.
  - Peripheral Ossifying fibroma.
  - Hemangioma.
15. Choose the CORRECT option: Which of the following is true?
- A pyogenic granuloma is associated with pus or pyogenic material.
  - The general histopathologic pattern of a peripheral Ossifying fibroma is primarily of a cellular connective tissue stroma with no associated mineralized components.
  - The recurrence of FRGL following the use of conventional excisional is not affected by Incomplete gingival excision or persistent gingival irritation after excision.
  - PGCG usually presents as a purple to dark red gingival mass.

#### Dental educators' views and knowledge of competencies required within a competency framework

16. Select the CORRECT answer: Dental education has transitioned from traditional to competency-based education (CBE), with competencies requirements for dental graduates on:
- Graduation.
  - Completion of community service.
  - Completion of the 4th year of undergraduate dentistry.
  - Completion of the 3rd year of undergraduate dentistry.
17. In this study, being a *health advocate*, as a competency, was highlighted:
- As an area of development for the curriculum.
  - As a strength in the curriculum.
  - As absent in this curriculum.
  - None of the above.

#### Evidence-Based Dentistry

19. Select the CORRECT answer: Which of the following variables are determinants that impact on a patient's ability to pay for health services? Distributive justice includes:
- Biological.
  - Contextual / environmental.
  - Sociobehavioural / cultura.
  - Socioeconomic factors.
20. Which of the following statements is CORRECT: In the Krishnan et al study, the findings suggest that:
- Random Blood Glucose (RBG) was significantly associated with increased risk of infectious complications.
  - Prophylactic antibiotics and warning about possible adverse healing for routine exodontia in type 2 DM patients is absolutely necessary.
  - Prophylactic antibiotics and warning about possible adverse healing for routine exodontia in type 2 DM patients is unnecessary
  - HbA1C values were significantly associated with increased risk of infectious complications.

#### ETHICS

##### Grillz and Gold Teeth – Esthetic, Economics and Ethics

21. Select the CORRECT option: It is morally justifiable to a dentist to provide gold teeth and grills because:
- Any treatment is better than no treatment.
  - Financial sustainability of dental practices is a critical to good clinical practice.
  - As long as the dentists feel it is in the interest of the patient.
  - Dentists are better placed to provide this care safely.
22. Choose the CORRECT answer: Ethical challenges about gold teeth and grills relate to:
- The high fees charged by dentists for these adornments.
  - Failure to get true informed consent.
  - The desire for dentists to benefit financial regardless of the harm to patients.
  - Whether or not these intervention proffer beauty to patients or not.

23. Choose the CORRECT answer: Ethical challenges about gold teeth and grills relate to:
- Includes dental adornments meant to make the patient present better, more beautiful.
  - Procedures used as top-ups or additions to the existing dentition.
  - Biomimetic dentistry or biomimetic procedures, aimed at 'recreating nature at its finest'.
  - Reversible procedures, causing lasting change or damage to dentitions and supporting tissues.
24. Which of the following options is CORRECT: The provision of grillz and gold inlays by dentists
- Typifies the collision of aesthetics, ethics and economics
  - Cause harm without any discernible benefits to the patients.
  - Represent blatant over-servicing or over-treatment.
  - Are clinically efficacious as anterior teeth restorations.
25. Select the CORRECT answer: Faced with patients requiring dental enhancements like grillz or gold teeth, dentist must
- Uphold and act in accordance to the principle of "primum non nocere".
  - Respect patient's autonomy at all costs.
  - Consider financial incentives.
  - Discourage wearing of grillz and gold teeth.

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