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THE SOUTH AFRICAN DENTAL ASSOCIATION

Venetian masks

Venetian masks are a centuries-old tradition of Venice, Italy. They were used to hide the wearer's identity and social status allowing the person to "be who they wanted to be, and do what they wanted to do" for that day. A poor man could be a nobleman, a woman could act like a man, or vice versa. Traditionally people were allowed to wear them during the Carnival of Venice, from the start of the carnival season (The festival of *Santo Stefano*, December 26) and throughout the festivities. They were also worn at midnight on Shrove Tuesday, during Ascension and from October 5 to Christmas, thus people could spend a large proportion of the year in disguise. Mask makers (*mascareri*) enjoyed a special position in society, with their own laws and their own guild. Perhaps we could wear similar masks during women's month of August allowing people of all sexes, race and age groups to enjoy equal rights, and privileges, but then maintain the momentum throughout the rest of the year!

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CONTENTS

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 August showcases a selection of Venetian masks.

Venetian masks
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CONTENTS

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The impact of COVID-19 on dental clinical competency training

SADJ August 2021, Vol. 76 No. 7 p393

NH Wood
Managing Editor of the SADJ

Training a dentist is not an easy task. We have all been through rigorous training and spent countless hours perfecting our technique and developing critical clinical skills. Generations of dentists have acquired a high level of knowledge and clinical competency and passed this down to new trainees in a consistent and time-honored manner. In the past, this cycle proudly maintained our profession in the highest standards of care.

However, the past two years saw a direct challenge to the traditional chairside teaching and training of students in dental schools. COVID-19 lockdown regulations dictate the number of people allowed in the clinical space, new and intensified infection control mechanisms that include aerosol and virosol management must be implemented, and the cleaning and disinfection of open clinical spaces now take longer than before. These, among other influences, have placed tremendous strain on the time in which the minimum clinical competency training goals can be achieved.

Dental training programs are regularly scrutinized and inspected by different stakeholders and accrediting authorities to ensure that dental schools deliver on the mandate to train clinically competent oral healthcare practitioners that service the country's needs. The dental schools also use internal quality control and assurance methods to regularly interrogate and update the curriculum, to benchmark against international standards of care, teaching and learning, and to introduce the latest in techniques and technologies to the dental student.

The culmination of the events of the past two years is forcing our tertiary institutions out of the "traditional training" comfort zone to develop and implement innovative and impactful teaching, learning and training strategies for clinical dentistry. This includes a thorough reconsideration of minimum clinical competency training. In a normal setting our curricula and training methods are fluid and regularly revised and enhanced. However, given the amount of clinical training time lost in the last year for various reasons, we run a serious risk not to deliver newly qualified and competent oral healthcare practitioners to serve the South African population in time.

A clinical competency is in essence any procedure or skill that is performed independently and completely, and repeatedly by the candidate, to the satisfaction of the trainer and assessor within defined exit level outcomes.

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This implies that a period of clinical orientation and training has taken place preceding the assessment process of the clinical competency. Traditionally this was achieved by larger numbers of procedures with regular feedback to the student as the levels of difficulty was increased over time. It seems now that high-impact, high-stakes assessments are becoming increasingly utilized as an adaptation for clinical competency assessment, and quite often it leads to a neglect of the preceding orientation phase of clinical training. Clinical disciplines now have to create new competency checklists and rubrics to ensure the holistic development of any individual practitioner, in the shortest amount of time possible, and still it has to be educationally sound.

Importantly: the core clinical competencies required to qualify a dentist remain in place and may even be growing in some instances. These competencies do not diminish, and portions thereof do not fall away simply because we don't have time to train clinicians. The onus therefore rests on the inspecting and accrediting authorities and statutory bodies to regularly communicate and enforce the requirements to the training institutions.

The dental schools in turn must ensure that the clinical competency training criteria are achieved ethically and correctly, and records must be kept for future reference. By simply reducing clinical exposure time to compensate for time lost in the COVID-19 pandemic is not educationally sound, does not deliver clinical skills or the development thereof, and has the potential for disastrous consequences in the communities that these individuals will be placed in.

The unavoidable ingredient required for clinical competency training is time spent on training and perfecting clinical skills and techniques. I want to urge our tertiary institutions and dental schools not to lose sight of this when updating dental curricula. This is an opportunity for Dentistry to shine and take the lead in the healthcare professions as an example of adaptation in the face of adversity, and to sustain high-quality clinical competency training from South Africa.

SADA Dental & Oral Health Virtual Congress and Exhibition

SADJ August 2021, Vol. 76 No. 7 p394

SADA Head Office

The association has finally reached the much-awaited month of the SADA Dental & Oral Health Virtual Congress and Exhibition. The congress will run from the 27th-29th August 2021 and the theme is "Back to the Future: Excellence in Dentistry".

This is the first time that SADA is venturing into this method of hosting the congress and we are very excited about it. The finer details can be found on the SADA congress website which is https://sadacongress.co.za/. Members and potential members of the association are strongly encouraged to be part of history by registering for the event.

The SADA scientific committee has put in a lot of work behind the scenes on the program to ensure that we bring you a rich mixture of local and international speakers who will be addressing topics that are relevant to clinical practice and the unique times that we are living in.

The rest of team has also worked extremely hard to put together an all-encompassing program, that will run from Friday to Sunday, that will accommodate practitioners of all ages from the freshly qualified or even those still studying to the most experienced physicians just in the comfort of your home or your surgery.

The team has put in plentiful effort ensure that the entire oral health team is encompassed in our package, which is why we have sessions that are relevant to specialists, general practitioners, dental therapists, oral hygienists, dental assistants, practice managers and receptionists.

We have worked very closely with our dental and non-dental traders who have also played a strong role in ensuring that we make this congress possible. Some of them have also sponsored our master classes so that we are able to give attendees a practical perspective to what the presenters would like to achieve.

The master class sessions will run on Friday and are sponsored by the following Traders and they have provided sponsorship to mostly our international speakers:

Ivodent
Scivision
Wright-Millners
Straumann
Henry Schein Dental Warehouse
Dentsply Sirona
Southern Implants

The congress organising team anticipates to achieve the following:

- An expected 1200 online delegates.
- 35+ Trade Exhibitor stands. (Meet them and check their products online)
- 23 International and 23 Locally based Speakers.
- 5 Master Class Sessions.
- Parallel Programmes allowing for a wide selection to fit your thirst for knowledge.
- We have something for everyone involved in Dentistry from Dental Assistants to Specialists.
- The Venue being your own safe space in this time of the pandemic.
- No travelling, no flights, no suitcases, no hotels.
- Rates are discounted by over 40%!

As per requirement the congress has also accredited in accordance with the HPCSA guidelines and the following allocation has been made:

Friday:	6 Clinical CEU's
Saturday:	7 Clinical CEU's
Sunday:	3 Clinical and/or 3 Ethical CEU's. (Max points for Sunday will be 4, determined by different session attendance)

Since this is not a space that we are not very familiar with, SADA has worked with Creative Space Media which is specialist event management, publishing, broadcasting and advertising agency. They facilitate strategic product and property sales through product development, content strategy and content development. High level relationship and business development with key clients and stakeholders. This has been an exciting journey that we are hoping to continue even beyond the 2021 Congress.

As the association we are hoping that this congress will assist delegates with their continuous professional development as required by the HPCSA and we are also hoping that this done in a fun and enjoyable manner. The responsibility of ensuring that members are compliant is one that we take very seriously because it has an added impact on the quality of oral health care that is provided to members of the public.

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27-29 AUGUST 2021

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The accuracy of various radiographic modalities for implant therapy

SADJ August 2021, Vol. 76 No. 7 p396 - p403

KR Beshtawi[1], S Shaik[2], MT Peck[3], M Chetty[4]

ABSTRACT

Aims and objectives

To investigate the dimensional accuracy of radiographic techniques utilized during implant therapy.

Design and Methods

Six dried human skulls were used to compare three dimensions in ten anatomical segments. Linear distances in-between metallic markers were measured and compared physically, and virtually on cone-beam computed tomography (CBCT) volumes, panoramic (PAN) and periapical (PA) radiographs. The angular distances along the curved arches of both jaws (connecting the upper metallic markers) were measured using cords. One-way ANOVA (p-value < 0.05) tests were executed to statistically analyze the mean differences between physical and virtual distances measured. The intra-class correlation coefficient (ICC) was used to analyze the level of consistency of observers.

Results

Statistically significant overall mean difference of all distances comparing physical and radiographic (CBCT, PAN, and PA), with the CBCT showed the least overall submillimeter discrepancy in the maxilla (M.D= -0.638 mm, SD= 0.203) and mandible (M.D=0.326 mm, SD=0.23).

Overestimations exceeding a millimeter were found in maxilla (M.D=2.229 mm, SD=0.856) and mandible (M.D =3.832 mm, SD=1.272) of measurements performed on panoramic radiographs. Periapical radiographs exhibited an overall mean maxillary underestimation of -3.707 mm, (SD=1.31) and mandibular mean overestimation of 1.849 mm (SD=0.875).

Conclusion

CBCT demonstrated a superior submillimeter overall accuracy in comparison to periapical and panoramic radiographs. While PAN and PA presented with individual dimension precision (submillimeter difference), the overall mean of difference for these modalities was inferior when compared with CBCT. CBCT showed superior dimensional stability and thus it is recommended during implant planning phases.

Keywords

CBCT, accuracy, panorama, implant, periapical.

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2. **Shoayeb Shaik:** Conceptualization, analysis, writing (review and editing) - 25%
3. **Mogammad T Peck:** Conceptualization, writing (review and editing) - 15%
4. **Manogari Chetty:** Conceptualization, writing (review and editing), supervision - 25%

INTRODUCTION

Radiographic assessment during various phases of dental implant therapy has become indispensable. Panoramic radiography is the most popular and the backbone radiographical procedure prescribed during daily practice and different phases of implant therapy.[1-3] On the other hand, the new era introduced by the cone-beam computed tomography (CBCT) aided to reform the treatment planning approaches and the diagnostic abilities of the practitioners.[4] CBCT allows for dimensionally accurate 3D imaging[5-7] that facilitates the aid of various applications e.g., computer-guided surgical procedures.[8]

Each radiographic modality can offer both advantages and drawbacks, but providing precise and reproducible dimensions of the anatomical site of interest is a vital requirement.[9,10] A submillimetre radiographic measurement error is still tolerable during implant treatment according to multiple reports.[11,12] Inconsistent evidence was found on the ideal radiographic modality (particularly from a dimensional accuracy perspective) that is most suitable to be used during the planning phase.[10]

The assessment of the vertical bone dimensions for implant purposes on the panoramic radiographs, especially in non-complex cases was reported.[3,10,13-18] On the contra-

ry, other reports[19-23] provided opposite evidence as these radiographs may predispose risks due to possible dimensional inaccuracies encountered (particularly if no magnification factors are considered).

As the maxilla and mandible are curved and in multi-dimensions, the presentation of these structures on a certain radiograph should be evaluated when a dimensional analysis is to be carried out for implant planning purposes; this indicates the consideration of angular measurements in certain anatomical regions (where applicable).

The authors presume that reproducing 2D radiographic dimensions on 3D physical structures (i.e., jaws) may predispose inaccuracies. The current investigation tries to add to the pool of evidence on the accuracy of linear and physical angular measurements (for implant planning purposes) in various radiographic modalities.

MATERIAL AND METHODS

Six dried human skulls (gender and ethnicity have been neglected) were collected from the Division of Clinical Anatomy, Faculty of Medicine, Stellenbosch University (Cape Town, South Africa) after obtaining ethical approval for degree purposes (Number: BM19/1/20, University of the Western Cape, South Africa). The adult-size skulls were provided with fully edentulous maxilla and mandible, and with the calvarium cut off. Metallic bearing balls of known diameter (4.5mm) were fixed directly on the mandibular and maxillary bone surfaces using a rigid sticky wax.

Five regions (segments) in each jaw were selected as follows: A-segment (anteriorly), M/C-segment (**M:** mental foramen region in the mandible and **C:** Canine segment in the maxilla), and P-segment (posteriorly). Each segment in the mandible contains three balls aligned in a triangular pattern (Y-ball placed on the top of the alveolar ridge, and two parallel balls with one on the buccal (X-ball) and lingual/palatal surfaces (Z-ball)). In the maxilla, only marker balls (X and Y) were placed (**Figure 1**).

Hight (DV: distance vertical), length (DH: distance horizontal), and width (DLA, DLP, DUA, DUP: distance lower/upper anterior/posterior) between these balls were measured physically by a digital caliber (Mastercraft®, South Africa) with 0,03mm accuracy, and 0,01mm repeatability.

The caliber readings were confirmed manually using a ruler before the analysis of every skull. Finally, thin nylon cords were fixed directly on the upper cortex of the ridge between the Y balls (conforming to the anatomy of the bone) and then measured by the caliber's ruler.

The skulls were mounted on a tripod during examinations with the mandibles that were supported with uniformly-sized sponges placed under the mandibular angles (bilaterally) simulating an ideal radiographic position. A uniform level between the left and right sides of the mandible was ensured using a combination square with a spirit level which also acted as a physical upper limit (tangent) for DV measurements.

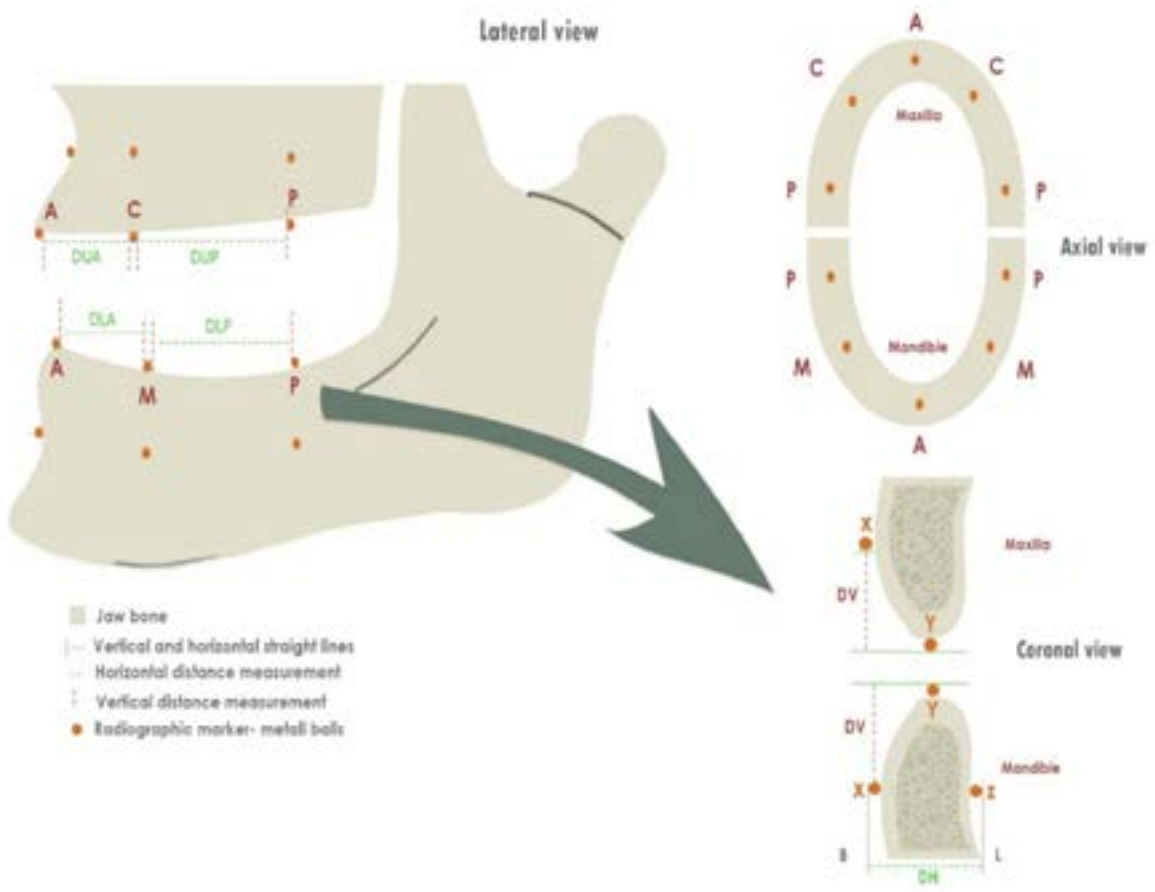

Figure 1. Measurements' diagram (Reprinted from Beshtawi, 2021).[40]

The ideal radiographic position during CBCT and panoramic examinations were ensured with the aid of the units' positioning laser markers (Figure 2).

Parallel radiographic technique (with the aid of film holders) was employed during intraoral periapical examinations. The corresponding radiographic measurements were carried out virtually (Figure 3).

Table I shows the models ofx-ray machines utilized, the exposure parameter selected, and the distances measured for each modality.

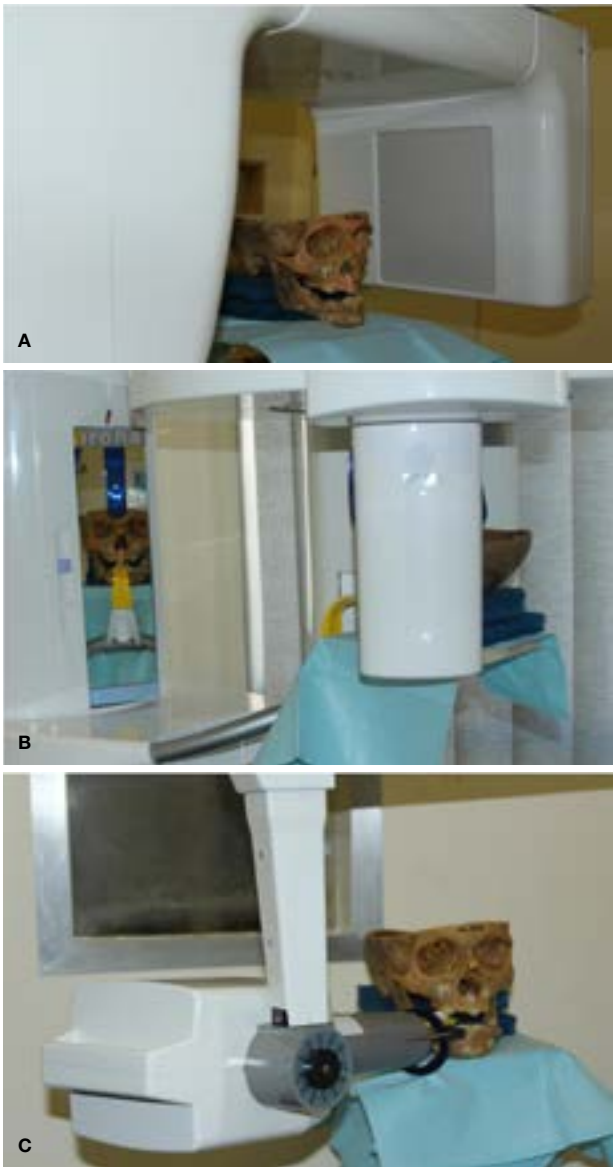

Figure 2. X-ray machines that were used (A) CBCT, (B) panoramic, and (C) periapical x-ray machines.

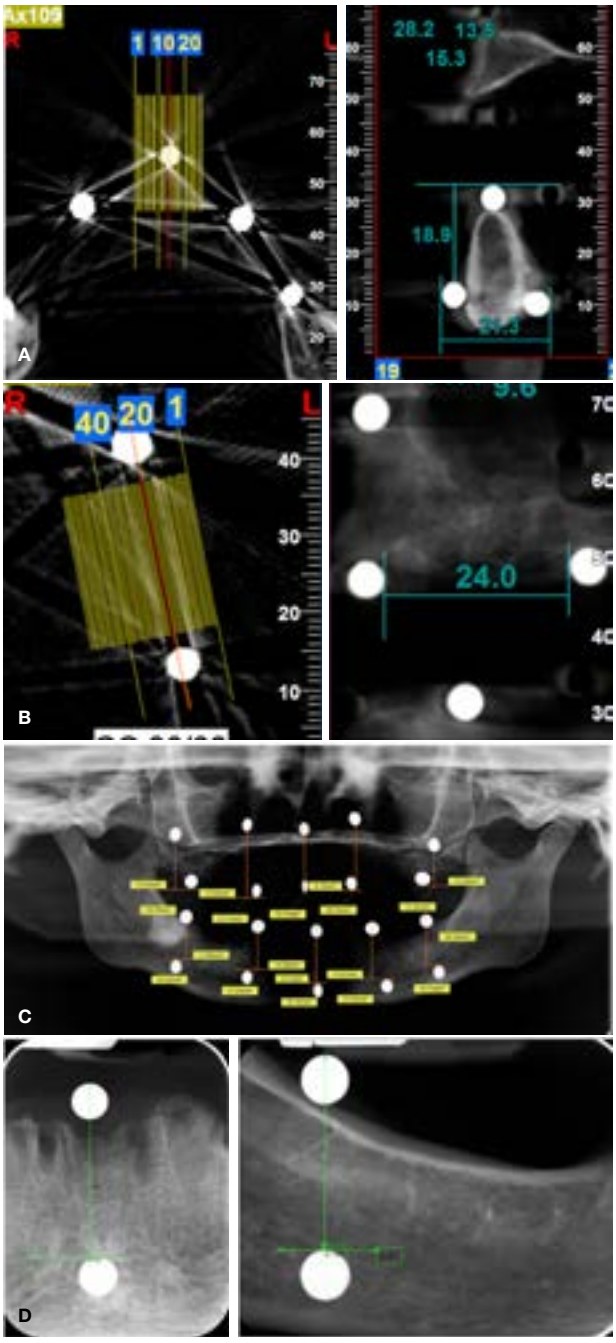

Figure 3. Virtual measurements captured on CBCT volumes (A&B), panoramic (C), periapical (D) radiographs..

Table 1. Radiographic x-ray models and exposure parameters used.

Modality	Model	Exposure parameters	Distances measured (maxilla and mandible)
PA	• Phosphor plates. • Plate scanner: SOREDEX® DIGORA™ Optime (Kavo/ Soredex®, Helsinki, Finland). • Desktop user-grade monitor.	70 kVp, 2 mAs	DV
PAN	• Sirona® Orthophos XG3 (Dentsply Sirona, Bernsheim, Germany). • Desktop user-grade monitor.	64 kVp, 112 mAs	DV, DLA, DLP, DUP, and DUA
CBCT	• Newtom® VGi (CEFLA s.c., Imola, Italy) • Barco® (Kortrijk, Belgium) Eonis 22" medical monitor 2MP (1920×1080 pixels).	"Full scan" mode 110 kVp, 1-10 mA	DV, DH, DLA, DLP, DUP, and DUA.

Key - PA: periapical, **PAN:** panoramic radiograph, **CBCT:** cone beam computed tomography, **DV:** distance vertical, **DH:** distance horizontal, **DLA:** distance lower anterior, **DLP:** distance lower posterior, **DUP:** distance upper posterior, and **DUA:** distance upper anterior.

Table 2. Overview of the statistical analysis at each anatomical point and at entire jaw measurement difference in millimeters (i.e., radiographic vs. physical measurements), (Reprinted from Beshtawi, 2021).[40]

Mandible					Mean value (SD)		CBCT vs. Physical	Pan vs. Physical	PA vs. Physical
RHS	Point p	DV	Physical	15.02 (3.4)	M.D	1.18	4.87	2.252
			CBCT	16.2 (3.1)	SD	-2.02	-2.02	2.02
			PAN	19.89 (3.9)	P.V	1	0.154	1
			PA	17.27 (3.6)				
		DH	Physical	18.59 (1.9)	M.D	0.362		
			CBCT	18.95 (2.1)	SD	-1.17		
					P.V	0.764		
		DLP	Physical	23.19 (3.9)	M.D	-0.738	1.63	
			CBCT	22.45 (3.8)	SD	-2.21	-2.21	
			PAN	24.82 (3.7)	P.V	1	1	
	Point M/C	DV	Physical	17.22 (4.2)	M.D	1.582	6.692	2
			CBCT	18.8 (4.4)	SD	-2.64	-2.64	-2.64
			PAN	23.91 (5.3)	P.V	1	0.118	1
			PA	19.22 (4.2)				
		DH	Physical	19.02 (0.9)	M.D	0.127		
			CBCT	19.15 (0.9)	SD	-0.538		
					P.V	0.819		
		DLA	Physical	18.63 (3.8)	M.D	-0.927	0.907	
			CBCT	17.7 (3.8)	SD	-2.3	-2.3	
			PAN	19.53 (4.4)	P.V	1	1	
	Center Point A	DV	Physical	16.05(4.41)	M.D	2.047	7.56	2.15
			CBCT	18.1(5.50)	SD	-3,036	-3,036	-3,036
			PAN	23.61(6.5)	P.V	1	0.13	1
			PA	18.2(4.27)				
		DH	Physical	21.44 (1.6)	M.D	0.31		
			CBCT	21.75 (1.5)	SD	-0.91		
					P.V	0.74		
LHS	Point M/C	DV	Physical	15.5 (3.4)	M.D	0.7	5.238	1.56
			CBCT	16.2 (3.6)	SD	-2.29	-2.29	-2.29
			PAN	20.74 (4.8)	P.V	1	0.199	1
			PA	17.06 (3.9)				
		DH	Physical	19.46 (0.7)	M.D	0.242		
			CBCT	19.7 (0.9)	SD	-0.46		
					P.V	0.611		
		DLA	Physical	17.05 (4.2)	M.D	-0.698	1.31	
			CBCT	16.35 (4.0)	SD	-2.31	-2.31	
			PAN	18.36 (3.8)	P.V	1	1	
	Point P	DV	Physical	13.41 (2.92)	M.D	0.49	3.94	1.28
			CBCT	13.9 (2.68)	SD	-1.83	-1.83	-1.83
			PAN	17.35 (3.52)	P.V	1	0.259	1
			PA	14.68 (3.435)				
		DH	Physical	19.56 (2.2)	M.D	0.34		
			CBCT	19.9 (2.2)	SD	-1.27		
					P.V	0.795		
		DLP	Physical	21.5 (5.1)	M.D	-0.452	2.33	
			CBCT	21.1 (5.2)	SD	-3.25	-3.25	
			PAN	23.83 (6.5)	P.V	1	1	
Overall						0.326* (0.23)	3.832* (1.272)	1.849* (0.875)

Maxilla					Mean value		CBCT vs. Physical	Pan vs. Physical	PA vs. Physical
RHS	Point p	DV	Physical	17.67 (1.6)	M.D	-0.671	1.155	-3.786
			CBCT	17 (2.0)	SD	1.07	1.07	1.07
			PAN	18.83 (2.4)	P.V	1	1	0,012*
			PA	13.89 (1.2)				
		DUP	Physical	22.29 (3.3)	M.D	-.698	1.55	
			CBCT	21.6 (3.2)	SD	1.99	1.99	
			PAN	23.85 (3.8)	P.V	1	1	
	Point M/C	DV	Physical	24.25 (4.1)	M.D	-0.15	3.97	-4.57
			CBCT	24.1 (3.9)	SD	2.41	2.41	2.41
			PAN	28.22 (4.8)	P.V	1	0.689	0.436
			PA	19.69 (3.8)				
		DUA	Physical	16.68 (3.9)	M.D	-0.73	1.32	
			CBCT	15.95 (3.9)	SD	2.39	2.39	
			PAN	18 (4.6)	P.V	1	1	
	Center Point A	DV	Physical	24.92 (2.5)	M.D	0.227	6.055	-0.8357
			CBCT	25.15 (2.6)	SD	2.07	2.07	2.07
			PAN	30.97 (4.1)	P.V	1	0.05	1
			PA	24.09 (4.7)				
LHS	Point M/C	DV	Physical	21.34 (2.4)	M.D	-0.293	3.801	-3.775
			CBCT	21.05 (2.5)	SD	1.56	1.56	1.56
			PAN	25.15 (3.1)	P.V	1	0.147	0.153
			PA	17.57 (2.8)				
		DUA	Physical	16.59 (3.9)	M.D	-0.988	1.465	
			CBCT	15.6 (3.7)	SD	2.313	2.313	
			PAN	18.05 (4.3)	P.V	1	1	
	Point P	DV	Physical	15.36 (3.2)	M.D	-1.807	-0.777	-5.578
			CBCT	13.55 (3.1)	SD	2.08	2.08	2.08
			PAN	14.58 (3.7)	P.V	1	1	0.086
			PA	9.78 (4.3)				
		DUP	Physical	21.73 (2.9)	M.D	-0.633	1.522	
			CBCT	21.1 (2.7)	SD	1.895	1.895	
			PAN	23.26 (4.0)	P.V	1	1	
Overall						-0.638* (0.203)	2.229* (0.856)	-3.707* (1.31)

*Statistically significant difference, p<0.05 , Negative values indicate underestimation while positive ones indicate overestimation.
M.D: measurement discrepancy, **SD:** standard deviation, **P.V:** p-value, **RHS:** right hand side, **LHS:** left hand side, **PA:** periapical, **PAN:** panoramic radiograph, **CBCT:** cone beam computed tomography, **DV:** distance vertical, **DH:** distance horizontal, **DLA:** distance lower anterior, **DLP:** distance lower posterior, **DUP:** distance upper posterior, and **DUA:** distance upper anterior.

A one-way ANOVA test was used to determine if there was a statistically significant difference between the physical and radiographic (CBCT, PAN, and PA) distances. Pairwise comparisons with Bonferroni correction were used to determine how large those differences were and to determine where those differences were.

If there were no statistically significant differences between the different modalities, then the two differences were deemed similar, as the p-value was greater than 0.05 and the confidence interval included zero. If the confidence interval included zero, this implied that at some stage the difference was zero and thus there was no difference in the estimation of the distance of the points between the physical point or any of the three modalities (CBCT, PAN, or PA). The mean measurement difference (M.D) was calculated in millimeters and using the following equation:

M.D = mean radiographic measurements – mean physical measurements

The intra-class correlation coefficient (ICC) was used to analyze the level of consistency of the results between the two observers. All the physical measurements were repeated a week after the primary analysis (except for the angular measurements) by both observers. The primary observer repeated all radiographic measurements in all the radiographic modalities a week after the primary analysis.

The second observer was requested to repeat the measurements for three skulls in each radiographic modality tested.

RESULTS

Statistical significance was elicited for all the overall mean differences between physical and radiographic distances (on PAN, CBCT, and PA) in both jaws. The panoramic overall mean distance differences in both jaws were overestimated (by 2.229 mm and 3.832 mm for maxilla and mandible, respectively). On the other hand, periapical radiographs' overall mean differences recorded underestimation of -3.707mm in the maxilla and overestimation by 1.849mm in the mandible. While both conventional two-dimensional modalities (i.e., PA and PAN) recorded mean differences exceeding a millimeter, CBCT, by contrast, provided the least submillimeter discrepancy in both, maxilla (M.D = -0.638 mm) and mandible (M.D = 0.326 mm).

In comparison to the overall mean difference, the statistical analysis of measurement differences acquired in each individual segment (point) did not elicit any statistical significance (between CBCT or PAN or PA vs. physical distances), except in the distance vertical (DV) of point P (R. maxilla) of the PA. Among all the investigated twenty-three individual points (segments), the mean differences between CBCT and physical distances were the least over the three modalities (Max. 2.047mm and Min. 0.127mm). The statistical analysis is further demonstrated in Tables 2 and 3.

Table 4 documents the differences between the linear and angular measurements (alveolar arc lengths), i.e., DUP/DLP, DUA/DLA. Of the 36 readings obtained, 21 of them exceeded the 1 mm (over or underestimating).

Table 3. Number of readings (i.e., showing discrepancies) per each imaging technique (Reprinted from Beshtawi, 2021).[40]

Comparison	PA (10 readings)	Pan (18 readings)	CBCT (23 readings)
Discrepancy over 1 mm limit (Over or underestimation)	9/10	16/18	4/23
Detailed description of data			
Overestimation (>0mm)	**5/10**	**17/18**	**11/23**
Maxilla	0	8|R* [1.15-6.05mm]	1|M* (0.22mm)
Mandible	5|R* [1.27-2.52mm]	9|R* [0.9-7.56mm]	10|R* [0.31-2.04mm]
Underestimation (<0mm)	**5/10**	**1/18**	**12/23**
Maxilla	5|R* [-0.83-5.57mm]	1|M* (-0.77)	8|R* [-0.15-(-1.8)mm]
Mandible	0	0	4|R* [-0.4-(-0.92)mm]

|R*: Range, M*: Maximum

Table 4. The differences between physical linear and angular distances in millimeters (Reprinted from Beshtawi, 2021).[40]

Skull #		Right side		Left side	
		DUP/DLP	DUA/DLA	DUP/DLP	DUA/DLA
1	Maxilla	**0,36**	**-5,04**	**0.95**	**-2,42**
	Mandible	0,78	-3,48	-1,58	-3,88
2	Mandible	0,25	0.84	0,04	-1,81
3	Mandible	**-0,78**	**-3,3**	**-3,08**	**-1,65**
4	Maxilla	-1,58	-0,44	-3,09	0.9
	Mandible	-4,03	0.54	-0,33	-1,08
5	Mandible	**-2,61**	**-2,55**	**-0,05**	**-4,64**
6	Maxilla	0,34	-4,9	-0,8	-6,41
	Mandible	-4,01	-2,8	-2,08	-0,24
Linear measurements - curved M.	*Positive values indicate that the linear measurements were bigger than angular ones and vice versa. Values in red: >1 or -1 mm difference (21 readings/36) Values in Black: -1>0<1 difference (15 readings/36				

Nonetheless, those 21 readings were all negative indicating that the angular measurements were more than the values of the linear ones (i.e., the linear physical distances underestimate their angular counterparts).

All measured distances showed excellent inter and intra-examiners reliability (using the intraclass correlation coefficient) except in three points (segments) which were poor, moderate, and good.

DISCUSSION

Despite the statistical significance elicited for the overall measurement discrepancies between physical vs. all radiographic modalities compared, clinically significant distortions were only attained from periapical and panoramic measurements. The discrepancy of measurements was inconsistent with the numerous anatomical segments investigated. In this investigation, it was noted that the reliability of the radiographic dimensions was highly influenced by the radiographic position during periapical and panoramic radiographic examinations. While the current investigation was performed under simulated clinical settings, such an approach may not be constantly achieved in an ordinary, everyday clinical environment. A submillimeter radiographic measurement discrepancy on CBCT volumes mentioned to be clinically insignificant.[24,25,26] Although we accept this small margin of error, it is challenging to consider the clinical significance of this minute discrepancy when related to the spatial location of vital structures, it can mean the difference between success and failure.

CBCT technique was reported to provide highly precise dimensions of the studied anatomical structures.[5-7,26-28] Within a high overall accuracy, slight measurement overestimation[25,29,30] and underestimation[7,31-33] were mentioned.[26] Consequently, during the planning of surgical procedures, a safety zone of 2mm still applies.[26] The current investigation concurs with the previous reports regarding the accuracy of CBCT while revealing an overall submillimeter accuracy (-0.638, 0.326mm for maxilla and mandible, respectively). Nevertheless, CBCT volumes showed an over-millimetre discrepancy in the vertical distance (DV) at 3 individual mandibular sites [1.18mm - 2.04mm] and one in the maxilla (-1.8mm).

Multiple factors may impact the accuracy of CBCT measurements e.g. the imposed artefacts (like beam hardening and motion artefacts), exposure settings, and the software used.[26] The head position does not affect the CBCT volume accuracy.[34,35] However, generating cross-sectional images based on an inaccurate and unsynchronized (radiographically and physically) virtual orientation of the head (particularly the sagittal tilting) might lead to inaccurate measurements if transferred to the patient's mouth, as it affects the height of subsequent cross-sections.[36] Some dimensional discrepancies discovered at the surgical setting are a result of the erroneous transfer of virtually performed measurements on the cross-sectional slices.[37] We, therefore, highlight the importance of accurate identification and synchronization of reference landmarks (radiographically and clinically).

The reproducibility of 2D radiographic linear measurements of 3D physical structures is the most likely source of discrepancies (Figure 4). The shortest linear distance measured (physically) between two segments (points) was -in general- less than the angular counterpart which was measured with the cord placed directly on the alveolar ridge. Such a finding should be considered clinically while performing "free-hand" implantology, and a reference measurement mark point to the drilling site need to be reproduced in the patient's jaw.

While possible magnification and inherent distortions are the main disadvantages, panoramic radiographs are a common radiographic procedure that offers a wide range of advantages.[1,38] Multiple reports indicated dimensional reliability and beneficial use of these radiographs especially in the posterior segments of the jaws;[3,10,13-18,39] yet, opposing evidence also exist.[19-23] Compared to our findings, the overall measurement discrepancies exceeded the 1mm range in maxilla and mandible (2.229, 3.832mm, respectively), indicating overall inferior accuracy. Out of 18 panoramic individual points measurements, the mean difference was over 1mm in 16 locations in maxilla and mandible, overestimated (>0mm) in 17 readings [1.15 – 7.56mm], and underestimated (>0mm) in one reading (-0.77mm).

Comparable findings were noted in periapical radiographs measurements where overall measurement discrepancies of -3.707 for maxilla and 1.849mm for mandible were found. Mandibular measurements showed less discrepancy – although >1mm- compared to maxillary ones. Although performed in a simulated ideal setting, anatomical variations (e.g., ridge inclination, shallow palate) in the maxilla may readily cause distortions, as ideal parallelism between the axis of the alveolar ridge and the x-ray receiver was challenging. In mandible and excluding the

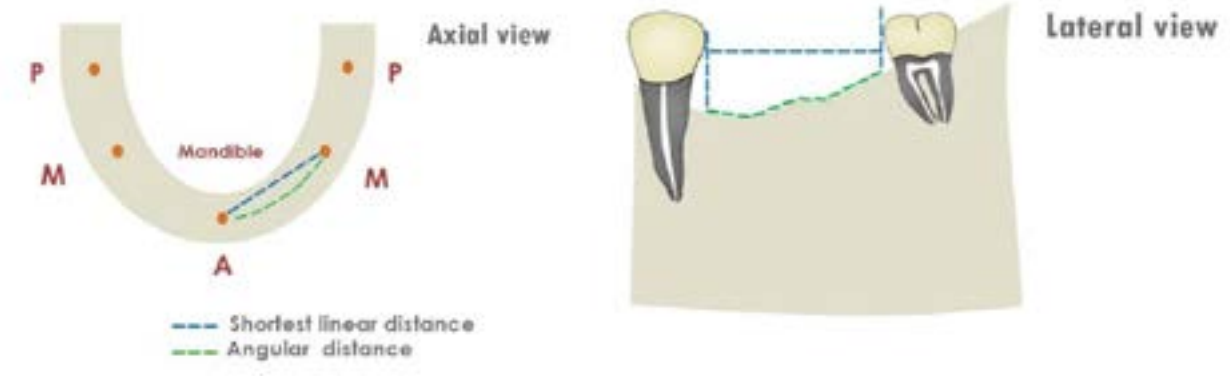

Figure 4. Illustration of the assumed angular distances between various jaw segments (Reprinted from Beshtawi, 2021).[40]

muscle repulsion (which may occur in real patients) in the floor of the mouth, achieving ideal parallelism was unchallenging and was translated in reduced measurement discrepancies in the mandible compared to the maxilla. Though PA showed accurate individual dimensions at multiple anatomical sites, the accuracy was inconsistent throughout the analysis. As a result, accurate reproduction of the anatomical structures may not be guaranteed in every clinical setting.

CONCLUSIONS

Compared to panoramic and periapical radiographs, CBCT achieved superior sub-millimeter accuracy in the maxilla and mandible. Measurements done at the maxillary sites showed more accuracy compared to the mandibular sites on panoramic radiographs, however, the highest discrepancy values were noted in the anterior regions. In contrast, the opposite was noted on periapical radiographs examinations i.e., measurements obtained from the mandible revealed better accuracy than the maxillary sites. While panoramic and periapical radiographs exhibited individual accurate measurements, the overall differences indicate inferior dimensional accuracy compared with CBCT. In this paper, the accuracy of the CBCT modality is verified and thus is recommended for implant planning.

Limitations

Angular measurements were not repeated for inter- and intra- observers' agreements.

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Disclosure

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An overview of COVID-19 infection in dental practices
- a questionnaire survey

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ABSTRACT

Introduction
Dental nurses and practitioners are at high risk of exposure to COVID-19 due to physical proximity and exposure to body fluids during treatment. Dental practices have implemented multiple protective protocols to decrease COVID-19 transmission; however, it is difficult to evaluate how effective these measures are, as there is limited data on COVID-19 in dental practices.

Aims and objectives
To evaluate COVID-19 infection rates among dentists, dental staff, and patients in different countries through an online survey, with a primary focus on South Africa (SA).

Design
Cross-sectional online survey.

Results
One hundred fifty-four participants from 52 countries answered the survey, 48.6% (n=561) from SA. COVID-19 infections were reported in 18.2% (n=210) of dental practices. Only 1.1% regarded the practice as the source of infection for dentists and staff who got infected.

In total, 13.9% (n=160) treated COVID-19 patients. SA presented a higher infection rate (19% vs 13%, p=0.04) and more frequent treatment of COVID-19 patients than the other countries combined (17% vs 11%, p=0.006).

Conclusion
These findings support the need to maintain strict infection control measures to decrease transmission of SARS-CoV-2 during the delivery of oral care.

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3. **Matthias Troelzsch:** Project administration, validation, resources - 25%
4. **E Todd Scheyer:** Project administration, validation, resources - 25%

INTRODUCTION

As the coronavirus disease pandemic unfolds with the second wave of infections, dental professionals have been faced with numerous challenges to maintain oral care delivery.[1] Because droplets composed of saliva and respiratory secretions constitute the leading route of transmission for SARS-CoV-2, the oral cavity plays a pivotal role in acquiring the virus and spread of the disease.[2]

While oral care is an essential part of healthcare, concerns have been raised about the transmission of the virus between dental practitioners, other dental staff members, and patients when undergoing dental procedures.[3] According to the Office for National Statistics (ONS) from the UK, dental nurses and dental practitioners, are among the professionals who present the highest risk for exposure to COVID-19 due to the physical proximity during dental treatment and frequent exposure to body fluids.[4]

The World Health Organization (WHO) has recommended the postponement of elective dental procedures to mitigate disease transmission. Their interim guideline to only perform urgent or emergency dental procedures is based on cross-infection potential through aerosols.[3] In many dental practices, there has been a decreased number of appointments, and reduced working hours, with patients experiencing an increased burden of oral disease, which is detrimental to general health.[5]

Dental practices around the globe have implemented multiple protective protocols to decrease COVID-19 transmission, according to guidelines from the WHO,[3] the US Centre for Disease Control (CDC),[6] the American Dental Association (ADA),[7] and from national regulato-

ry bodies in different countries. It is difficult to evaluate the effectiveness of the adopted infection control measures, as currently there is limited data on COVID-19 infections in dental practices. Among US dentists, the ADA has recently estimated the prevalence of COVID -19 infection to be below 1%.[8] In Brazil, the National Dentistry Council, reported that only 0.2% of COVID-19 infections in the country affected dental professionals.[9]

The present study aimed at evaluating COVID-19 infections among dentists, dental staff, and patients in different countries through an online survey, with the main focus on South Africa. This study's results can contribute to a better understanding of the risks for transmission of coronavirus disease related to oral healthcare delivery.

MATERIAL AND METHODS

Study design

This study was designed as an anonymous cross-sectional online survey developed by the South African Implant and Aesthetic academy using Survey Monkey™ (SVMK Inc. San Mateo, CA, US). The questionnaire was available from 15th August 2020 to 15th September 2020, being composed of nine questions.

Questionnaire

An electronic informed consent to voluntarily participate in the study was embedded in the first question. Questions 2 and 3 concerned workplace type and physical location. In question 4, the profession of the respondent was recorded. Questions 5 to 9 were related to COVID-19 infections in the participant's dental practice, treatment of COVID-19 patients, and patient infection rate after visiting the practice.

Participant recruitment

A South African dental academy alumni group (total of 445 members, anonymized as per submission request) was invited to participate in the survey via mobile instant messing and were encouraged to share the survey with their peers.

Data analysis

The answers to the survey were automatically recorded by the SurveyMonkeyTM software and exported as Excel spreadsheets. Data were presented as absolute and relative frequency. The data was analyzed in STATA 15.1 (StataCorp LLC, Texas, US) according to the physical location. The chi-square test was used to analyze differences in frequencies for South African participants compared to other countries' participants. An alpha value below 0.05 was considered statistically significant.

RESULTS

Demographics

In total, 1154 participants representing 52 different countries answered the online survey. With regards to the location of the participant's dental practice, nearly half were located in South Africa (48.6%, n=561), followed by United States (17.2%, n=199), and Belgium (7.9%, n=91, Figure 1).

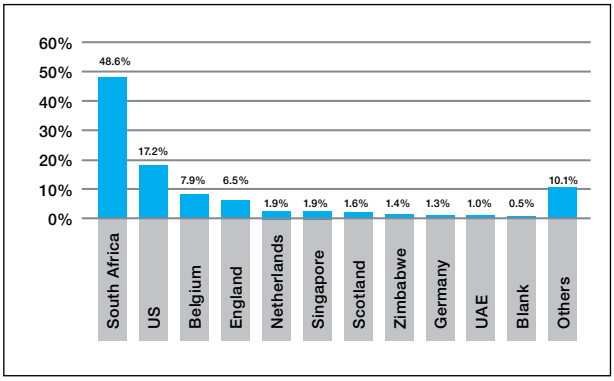

Figure 1. Survey participants according to country.

In total, 70.1% of the respondents were general dentists (n=809), 24.6% were specialist dentists (n=284), 2.2% were dental assistants or dental nurses, and the remaining 3.1% (n=36) represented other staff.

Regarding the workplace, the majority (89.4%, n=1032) worked at private dental clinics, 6.9% (n=79) worked both at private and public dental clinics, 2.7% (n=31) worked at public dental clinics, and 1.0% (n=12) had other work settings.

COVID-19 infection – dentists, dental assistants, and dental staff

The majority of the participants reported no COVID-19 infections in their practices (78.2%, n=902). In total, 18.2% (n=210) reported COVID-19 infections in their practices, from which 88.5% (n=186) were confirmed by a laboratory test, and 11.5% (n=24) lacked diagnostic confirmation.

Less than 4% of the sample did not know if there were COVID-19 infections in their practices. When South Africa's responses were compared to the rest of the world (Figure 2), South Africa presented a higher infection rate than the other countries combined (19% versus 13%, p=0.04, Figure 2).

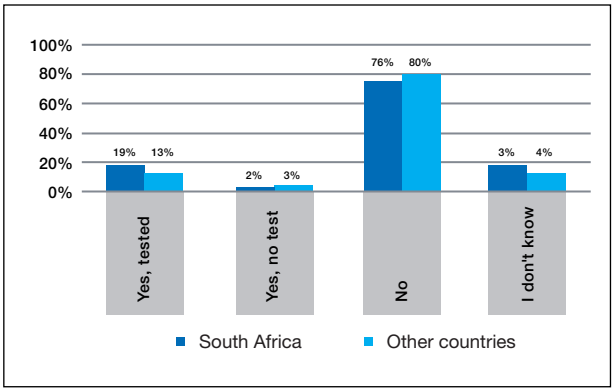

Figure 2. COVID-19 infections in respondent's practices according to the location (p=0.04).

When asked about how the respondent or clinic staff acquired COVID-19 infection, 11.2% (n=137) answered

'outside the practice', 10.3% (n=119) did not know, 1.1% (n=13) answered 'inside the practice', and 77.4% report no infections.

COVID-19 infection – patients

Regarding COVID-19 infection of patients after visiting dental practices, 91.8% of respondents had no reported patient infection, 3.8% did not know, 3.6% reported having patients infected 1-2 weeks after visiting the practice, as confirmed by laboratory tests, and 0.8% reported unconfirmed patient infection.

According to the survey, 13.9% (n=160) of the participants reported treatment of laboratory-confirmed COVID -19 patients. When evaluated by location, 17% of South African respondents treated laboratory-confirmed COVID -19 patients compared to 11% of respondents from other countries (p=0.006).

There were no statistically significant differences in infection rates for respondents who reported treatment of confirmed cases in their practices (14%, n=22 infections reported by 160 participants) and those who did not treat confirmed COVID-19 patients (19%, n=188 infections reported by 994 participants, p=0.127).

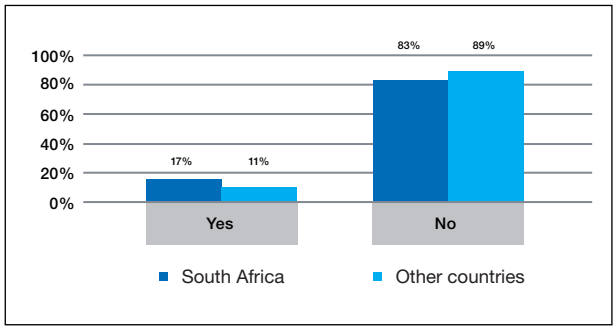

Figure 3. Treatment of laboratory-confirmed COVID-19 positive patients at respondent's practices according to the location (p=0.006).

DISCUSSION

The majority of the participants were dental practitioners who work in private practices, with nearly half being located in South Africa. In total, 18.2% of the participants reported COVID-19 infection in their practices, and the majority of infections were confirmed by a laboratory test (88.5%). Only 1.1% of the participants reported infection of dentists or dental staff acquired at the practice.

Regarding patient infection, 3.6% had patients infected 1-2 weeks after visiting the practice. It is important to reiterate that the infection's true origin cannot be confirmed, as transmission could have taken place outside the dental practices or anywhere else. Overall, 13.9% treated COVID-19 positive patients.

South Africa presented a higher infection rate and more frequent treatment of COVID-19 patients than all other countries combined. This is the first study to provide information on COVID-19 infections among the South African dental community to the best of our knowledge.

The occupational COVID-19 risk of dentists and dental staff has been estimated to be high due to the infective potential of saliva droplets and dental-generated aerosols.[10] There is limited data on COVID-19 infection rates for dentists and dental staff. A study from the ADA estimated the infection rate for US dentists at 0.9%, with 3.7% of survey respondents having tested positive via respiratory samples.[8] Brazil's National Dentistry Council estimated dentists' infection rate to be 0.2% based on the country's total number of infections.[9] In the current survey, infection of any member of the dental team was reported by participants, with no separate data on dentists. The higher rate observed in the present study can be the result of selection bias. Dentists who did not have infections in their practices might have been less likely to participate, which could lead to overestimation of COVID-19 infection rates.

The prevalence rate of COVID-19 in the general population has been estimated to be around 2%.[11] In 44% of frontline healthcare workers in the UK, there was evidence of SARS-CoV-2 infection.[12] In a meta-analysis, the prevalence of infection among healthcare workers worldwide ranged from 0.4% to 57.1%, with a pooled estimate of 11%.[13] Thus, the reported infection rate in the current survey was higher than the infection rate of US and Brazilian dentists, but was in accordance with infection rates for healthcare professionals.

Considering the general population infection rate of 2% for SARS-CoV-211, findings from this survey suggest that visiting a dental practice could increase the risk for infection, as 4.3% of participants reported patient infection after a visit to the dental practice. But these results should be interpreted with caution, since tracing the origin of COVID-19 infections is challenging and multiple risk factors have been implicated in the epidemiology of the coronavirus disease, including host defense, underlying health conditions, adherence to social distancing, exposure to infected individuals, age, and personal hygiene habits.[14]

Findings from this survey indicate that nearly 14% of dental practices had COVID-19 positive patients who needed dental treatment, which increases the occupational COVID-19 risk of the dentist and dental staff and highlights the need for strict infection control measures to protect the dental team. In a survey from Brazil, 5.3% of dentists reported treatment of COVID-19 patients.[15]

Although an explanation for the higher treatment of COVID -19 patients in South Africa cannot be readily found, the higher number of dentist per inhabitants in Brazil is twice as high as recommended by the WHO (1:753),[16] which is extraordinarily higher than the dentist to population ratio of 1:8,900 in South Africa.[17]

In this survey, only 1.1% of respondents attributed COVID -19 infections of dental practitioners and their staff to dental practices, which is low compared to the frequency of treatment of COVID-19 positive patients (13.9%). In addition, treatment of confirmed COVID-19 positive patients did not increase the reported infection rates for dentists and their staff, indicating that infection control protocols are being successfully followed when COVID-19 patients require emergency treatment.

The biggest challenge in dental settings is likely the a-symptomatic carriers of the coronavirus. Identification of infected and asymptomatic patients is essential to limit the infection risk of dental practitioners and staff. For this reason, accurate and affordable point-of-care diagnostic tests for SARS-CoV-2 that provide results within minutes, are warranted. This can facilitate the decision-making process related to clinical patient care, thus reducing the pressure on health professionals.[18] However, a recent Cochrane meta-analysis reported that most commercialized point-of-care tests still lack data on accuracy and usefulness in clinical practice.[19]

The infection rate among dental professionals can be affected by multiple factors that were not evaluated in the survey, such as using PPE and other infection control protocols, access to diagnostic tests, and the number of patients who visited the dental practice during the pandemic, among others. Results from this survey rely on the accuracy of COVID-19 diagnostic tests, which can be subject to false-negative and false-positive results, as highlighted in the survey study performed by the ADA. Lastly, even though respondents reported that most infections of dentists and dental staff were community-acquired, the actual source of COVID-19 infection is difficult to ascertain, as mentioned previously, making these findings difficult to interpret.[20]

Because of the infectious and inflammatory nature of ubiquitous dental diseases such as caries and periodontal disease,[21] not all treatments can be delayed as it can be detrimental for oral and general health. Also, likely, most COVID-19 patients who develop acute problems cannot wait until the infection is over to receive emergency care. Therefore, optimization of infection control protocols is mandatory in dental settings to protect dental professionals, staff, and patients in pandemics.[22] This is of particular importance given the increased infectivity and higher transmissibility of emerging SARS-Cov-2 new variants.[23]

CONCLUSIONS

The work environment of dental professionals leads to high exposure to respiratory diseases such as coronavirus disease. The COVID-19 infection rate in dental practices was higher than the general population's estimated rate but comparable to most reported rates for healthcare workers.

South Africa had more infections and more frequent treatment of COVID-19 patients. These results support the need for strict infection control measures in dental practices to decrease the risk of transmission of SARS -CoV-2 to the dental team and patients during oral care delivery.

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Rice vinegar removes *Candida albicans* from denture acrylic resins

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ABSTRACT

Introduction

Denture stomatitis, mainly caused by *Candida albicans*, often affect denture wearers. To manage these patients, denture hygiene is of utmost importance. There is a need for low cost, easily accessible denture disinfectants.

Aims

To investigate the efficacy of rice vinegar and other disinfecting solutions in removing *C. albicans* from acrylic resins.

Materials and methods

Hundred and eighty acrylic resin plates were contaminated with *C. albicans* strains and divided into five groups. These were immersed in apple cider vinegar (ACV), white wine vinegar (WWV), rice vinegar (RV), chlorhexidine (CHX), and sterile distilled H2O (control). The plates were incubated at room temperature for 30 minutes, 1 hour and 8 hours. *Candida* removing ability of the disinfecting solutions was evaluated, and data was analyzed using two-way ANOVA with Tukey post-test. Significance level of $p<0.05$ was used.

Results

RV, ACV, WWV and CHX showed the highest efficacy (100%) in removing both *C. albicans* strains at 8 hours ($p>0.05$). CHX was the most effective disinfectant in removing both *C. albicans* strains at 30 minutes, 1 hour, and 8 hours (99%-100%).

Conclusion

RV was as effective as ACV, WWV and CHX in removing *C. albicans* from acrylic plates at 8 hours.

Keywords

Rice vinegar. Denture acrylic resin. *Candida albicans*. Disinfection.

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3. **Mulalo Molaudzi:** Study conception and design, acquisition of data, analysis and interpretation of data, drafting of manuscript, critical revision - 25%
4. **Julitha Molepo:** Study conception and design, analysis and interpretation of data, drafting of manuscript, critical revision - 20%

INTRODUCTION

According to the World Health Organization, globally approximately 30% of people aged between 65-74 years are edentulous,[1] with many replacing lost teeth with dentures. Denture hygiene remains the mainstay preventive measure in the management of denture-wearing patients.[2]

Denture stomatitis, a mucous membrane inflammation, occurs on the denture-bearing mucosa of denture wearers. It is a common finding amongst denture wearers (15-70%), with women commonly affected.[3,4] Several factors, including patient age, age of denture, oral hygiene, diet, smoking, denture trauma, continuous denture wearing, salivary flow, denture base material, cellular immunity, pH of the denture plaque, and oral microorganisms contribute to the onset of the disease.[4-8] *C. albicans* is reported as the primary causative agent of the disease.[9,10]

Denture base acrylic resin is a significant contributing factor to the oral colonization of the denture by *C. albicans*. Dentures have rough fitting surfaces, which are conducive for adherence of *Candida* species and formation of the biofilm.[11] In order to control this colonization and prevent *Candida* infections, the removal of these organisms from dentures is imperative. Antifungal agents are used for treatment of *Candida* associated denture stomatitis. However, if the dentures are not properly cleaned and disinfected, denture stomatitis recurs when treatment is ceased.[12] Whilst more people have access to dental care, thus retaining their natural teeth for longer, most elderly people continue to lose their teeth, rendering them prone to denture stomatitis.[13]

Chlorhexidine gluconate (2%) antiseptic mouthwash has been used as a soaking solution to suppress adhesion of *Candida* to acrylic dentures.[14] However, the use of chlor-

hexidine leads to a brown discoloration of the denture, and has a bitter taste, which may reduce compliance.[15]

Although previous studies have tested the removal of *C. albicans* from a denture base using acetic acid/vinegar,[16-20] no South African study has tested and compared the effect of different types of vinegars on the removal of *C. albicans* from acrylic resin bases over different time periods. In addition, there are no documented studies on the use of rice vinegar (RV) as a denture cleanser.

Several denture cleansers are readily available on the market; however, the high cost leads to less than 60% of denture wearers using commercially available cleansers.[16] Therefore there is a need for low cost, easily accessible denture disinfectants. Vinegar is cheap and readily available in South Africa. The objective of the study was to investigate the efficacy of RV and other disinfecting solutions in the removal of *C. albicans* from denture acrylic resin.

MATERIALS AND METHODS

Denture acrylic resin plates and disinfecting solutions

One hundred and ninety-two denture acrylic resin plates measuring 10×10×3mm were prepared according to the manufacturer's instructions (Confi-Dent agencies, Johannesburg, South Africa). The plates were kept in a flask containing sterile normal saline, and sterilized in an autoclave at 121ºC/15 min.

The vinegars tested were 6% white wine vinegar (WWV), 5.5% RV, and 5% apple cider vinegar (ACV), all obtained from Instant Trading Co. (Pty) Ltd, Durban, South Africa. Chlorhexidine (CHX) (0.12%; Sunstar Americas, Inc, Ontario, Canada) was included as a positive control and sterile distilled water as a negative control.

C. albicans biofilm formation on denture acrylic resin plates

This study was conducted in the Department of Oral Biological Sciences, University of the Witwatersrand. *C. albicans* strains used in the study were the ATCC 90028 (National Health Laboratory Services (Johannesburg, South Africa), and a clinical *C. albicans* isolate. This isolate was obtained from an HIV positive patient (hereafter referred as clinical *C. albicans* strain) from a previous study and was stored in a -80°C freezer in the Department of Oral Biological Sciences. Ethical clearance to conduct the study was obtained from the Human Research Ethics Committee (Certificate No: W-CJ-150205-3).

For biofilm formation, a method described by Jafari, et al.[17] (2012) was followed, with slight modifications. The two *Candida* strains were grown on Sabouraud's Dextrose Agar (SDA) plates at 37°C for 48 hours. *Candida* suspensions were prepared by dissolving colonies in 20ml of sterile normal saline and turbidity adjusted to 0.5 McFarland standard (Difco Laboratories, Detroit, MI, USA), equivalent to 1.5 x 108 *Candida* cells per milliliter. Ninety sterile denture acrylic resin plates were contaminated with the *C. albicans* ATCC 90028 strain, while 90 were contaminated with a clinical *C. albicans* strain. This was done by immersing the plates in 3ml sterile Sabouraud's Broth in test tubes and adding 200µl of *Candida* suspension to each tube. The tubes were incubated at 37°C in a shaking incubator (100rpm) for 48 hours.

Disinfection of denture acrylic resin plates

The 90 denture acrylic resin plates contaminated with the *Candida* ATCC 90028 strain and 90 contaminated with a clinical *C. albicans* strain were randomly divided into five groups of 18 each. Group 1 plates were immersed in 20ml of 5% ACV, group 2 in 20ml of 6% WWV, group 3 in 20ml of 5.5% RV, group 4 in 20ml of 0.12% CHX and group 5 in 20ml of distilled water (H_2O; control).

The plates from each group were all incubated at room temperature and after 30 minutes, 6 plates were removed from each group and processed to determine viable *Candida* cells (colony forming units; CFUs). The same procedure was repeated after 1 hour and after 8 hours. Six acrylic plates contaminated with *Candida* ATCC 90028 strain and six contaminated with a clinical strain, but not exposed to any of the disinfecting solutions were included as controls.

Cell viability

To determine *Candida* cell viability, the denture acrylic resin plates were aseptically suspended in 20ml of sterile saline and vortexed for microbial cell detachment. Serial dilutions were prepared from this suspension by mixing 0.1ml of each suspension with 0.9ml of sterile phosphate buffered saline (1:10), which was further diluted by adding 0.1ml of this suspension into another 0.9ml of PBS (1:100). One hundred microliters of these dilutions were spread in duplicate on SDA plates and incubated for 48 hours at 37°C.

These tests were repeated three times for each of the two *C. albicans* strains for reproducibility of results. The *Candida* removing ability of ACV, WWV, RV, CHX, and H_2O was calculated by using the formula: $(CFU_b - CFU_a) \div CFU_b \times 100$, where CFU_b=Number of CFUs before disinfection and CFU_a =Number of CFUs after disinfection.

Statistical analysis

The data was analyzed using GraphPad Prism (Graph Pad Software Inc., La Jolla, CA). Two-way-ANOVA with Tukey's post-test was used for comparison of the *Candida* removing ability of ACV, RV, WWV, CHX, and H_2O at different times. A significance level of less than 0.05 ($p<0.05$) was used.

RESULTS

The removing ability of different disinfecting solutions at different time intervals are illustrated in **Table 1** (ATCC strain) and **Table 2** (Clinical strain). At 8 hours, ACV, WWV, RV, and CHX showed the highest efficacy (100%) in removing ATCC 90028 and clinical *C. albicans* strains from acrylic resins. CHX was the most effective disinfectant in removing both strains of *C. albicans* at 30 minutes, 1 hour, and 8 hours (99% - 100%).

For ATCC at 30 minutes and 1 hr, WWV was the next most effective after CHX (92 and 97% respectively). For clinical strain, at 30 minutes and 1 hr, WWV was the next most effective after CHX (82 and 73% respectively).

Sterile water could not completely remove either of the *C. albicans* strains at 30 minutes, 1 hour and 8 hours.

For the ATCC 90028 strain, there was no statistically significant difference between ACV, WWC, RV and CHX at 30 minutes, 1 hour and 8 hours ($p>0.1$) in removing this strain from denture acrylic resin plates. There was statistically significant difference between ACV, WWV, RV, CHX when compared to water at 8 hours ($p=0.0002$).

There was no statistically significant difference between ACV, WWC, RV and CHX at 30 minutes, 1 hour and 8 hours in removing the clinical strain from denture acrylic resin plates ($p>0.3$). However, there was statistically significant difference between ACV, WWC, RV, CHX, and water at 8 hours ($p<0.05$).

DISCUSSION

Denture stomatitis is caused mainly by the adherence and colonization of *C. albicans* on the fitting surface of the denture. In order to control this infection, it is important to remove this organism by disinfecting dentures, and there is a need for low cost and easily accessible denture disinfectants.

Vinegar is cheap, has low toxicity[21] and is readily available in South Africa. It is a sour liquid comprised mainly of acetic acid, which is prepared by the fermentation of alcoholic beverages, mainly white and red wines.[22] *C. albicans* is the main causative agent of denture stomatitis, and thus using this solution in the disinfection of dentures might prove beneficial both therapeutically and as a preventive measure.[23]

This study aimed to investigate the efficacy of RV and other disinfecting solutions in the removal of *C. albicans* from denture acrylic resin. In this study, RV was found to be as effective as CHX, ACV and WWV in removing *C. albicans* from acrylic denture resin at 8 hours.

Previous studies have tested the removal of *C. albicans* from a denture base using acetic acid/vinegar.[16,17,20,23,24] However, there are no documented studies on the use of RV as a denture cleanser. In this study, RV (5.5%), WWV (6%) and ACV (5%) removed 100% of *C. albicans* ATCC 90028 and clinical *C. albicans* strains from denture acrylic resin plates at 8 hours but did not completely remove these strains at 30 minutes and 1 hour. This shows that longer soaking periods are required to remove *C. albicans* from acrylic dentures using these vinegars.

Table 1. Efficacy of different disinfecting solutions in the removal of *C. albicans* ATCC strain from denture acrylic resin plates.

	30 minutes				1 hour				8 hours			
	CFUs				CFUs				CFUs			
	Before Disinfection	After Disinfection	Removing Ability	P value	Before Disinfection	After Disinfection	Removing Ability	P value	Before Disinfection	After Disinfection	Removing Ability	P value
Apple cider vinegar	48666	3483	89%	ACV, WWV, RV, CHX, H_2O >0.1	48666	1750	94%	ACV, WWV, RV, CHX, H2O >0.1	48666	0	100%	ACV, WWV, RV, CHX >0.9999
White wine vinegar		2533	92%			883.33	97%			0	100%	
Rice vinegar		10100	83%			4783.33	91%			0	100%	
Chlorhexidine		0	100%			0	100%			0	100%	
Water		4583.33	86%			5516.67	75%			11416.67	74%	ACV, WWV, RV, CHX and H_2O 0.0002
	30 minutes				1 hour				8 hours			
	CFUs				CFUs				CFUs			

ACV - Apple cider vinegar; WWV - White wine vinegar; RV - Rice vinegar; CHX - Chlorhexidine; H_2O; CFUs - Colony forming units

Table 2. Efficacy of different disinfecting solutions in the removal of *C. albicans* clinical strain from denture acrylic resin plates.

	30 minutes				1 hour				8 hours			
	CFUs				CFUs				CFUs			
	Before Disinfection	After Disinfection	Removing Ability	P value	Before Disinfection	After Disinfection	Removing Ability	P value	Before Disinfection	After Disinfection	Removing Ability	P value
Apple cider vinegar	26000	10350	60%	ACV, WWV, RV, CHX, H_2O >0.1	26000	8633.33	66%	ACV, WWV, RV, CHX, H2O >0.3	26000	0	100%	ACV, WWV, RV, CHX >0.05
White wine vinegar		4616.67	82%			7400	73%			0	100%	
Rice vinegar		5266.67	80%			8900	65%			0	100%	
Chlorhexidine		116.67	99%			233.33	99%			0	100%	
Water		6100	77%			7583.33	71%			5650	78%	ACV, WWV, RV, CHX and H_2O <0.05

ACV - Apple cider vinegar; WWV - White wine vinegar; RV - Rice vinegar; CHX - Chlorhexidine; H_2O - Water; CFUs - Colony forming units

There are no documented studies where the efficacy of RV against *C. albicans* on denture acrylic resin plates was tested. To the best of our knowledge, this is the first documented study where RV was tested and found to be effective as a denture cleanser. However, Choi, et al.[25] (2015) reported that dark RV has strong antioxidant and antimicrobial activity, and was more effective than carbenicillin (50 µg/ml) and tetracycline (50 µg/ml) in inhibiting growth of bacterial species.

Mota, et al.[20] (2014) reported 4% ACV to be fungicidal between 30-180 minutes, in contrast to the current study. They also found that ACV prevented *C. albicans* from adhering to the acrylic resin, and suggested that ACV could be used as an alternative therapeutic agent in denture stomatitis patients.

There are very few documented studies on the effectiveness of ACV in removing *C. albicans* from denture materials. However, using gel diffusion methods, ACV was effective against *C. albicans* after 24 hours' exposure.[26-28]

A study by Jafari, et al.[17] (2012) showed that 5% and 10% white vinegar removed 99% and 100% of the *C. albicans* attached to acrylic plates respectively after 8 hours, confirming the efficacy of white vinegar, in agreement with the current study. Another study found that using a higher concentration (125ml/200ml) of vinegar was effective in removing *C. albicans* from acrylic plates in a shorter time (1 hour), while a lower concentration (75ml/200ml) took longer to remove *C. albicans* (8 hours).[29] Their results suggest that increasing vinegar concentration would shorten the efficacy time.

In contrast to our results, Pinto, et al.[16] (2008) reported that 10% vinegar could not eliminate *C. albicans* from dentures and saliva of denture wearers after 45 days of overnight exposure, but reduced the amount (cfu/mL) of *Candida* species in the saliva.

Vinegar was ineffective in reducing *C. albicans* colonization on denture materials after 10 minutes' exposure,[30,31] whilst 50% vinegar diluted in water was less effective than alkaline peroxide in removing *C. albicans* biofilms after 30 minutes.[18] Kumar, et al.[32] (2012) reported 4% and 50% vinegar to be less effective in removing *C. albicans* from acrylic resin after 8 hours exposure compared to commercial solutions, which is also in contrast to our study findings. Higher concentrations of vinegar (100%) with shorter exposure times were effective in removing *C. albicans* from dentures.[23,24,33,34]

The results of the current study show that 5.5% RV, 6% WWV, and 5% ACV are effective (100% efficacy) and can be used as denture cleansers, allowing denture wearers to soak their dentures overnight, ready for use the next day. This will be beneficial for denture wearers, as all these vinegars are cheap and are available in every household around the world.

In the current study, 0.12% CHX was the most effective disinfectant in removing both tested *C. albicans* strains (99 - 100%) at 30 minutes, 1 hour, and 8 hours. This is not surprising as CHX is considered the gold standard agent for controlling dental plaque effectively.[35]

Water could not completely remove either *C. albicans* strains at 30 minutes, 1 hour, and 8 hours. These results are in agreement with previous studies, where water was less effective in removing *C. albicans* from dentures[36-38] confirming that water alone is not suitable for disinfection of dentures. The ability of water to reduce *C. albicans* from acrylic resin can be explained by that water is hypotonic as compared to the cellular contents of microorganisms, and this lead to osmotic pressure, causing the flow of water into the cells and disrupting the microorganisms.[39]

The limitation of this study is that it was an *in vitro* study. Further studies are needed to confirm the efficacy of RV *in vivo*. In addition, the long term effects of RV on the denture acrylic requires further study to assess its effect on the mechanical strength of denture acrylic over time, amongst others. Further studies are needed to determine the duration of time or the number of times the same RV solution could be used, before it loses its effectiveness. Such a study will further confirm the cost-effectiveness of vinegar as a disinfectant.

CONCLUSION

Within the confines of this study, 5.5% RV was as effective as 5% ACV, 6% WWV and 0.12% CHX in removing *C. albicans* from dentures after overnight soaking. This is the first study where RV was tested and found effective as a denture cleanser.

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Orthodontic status and treatment need of 13 to 15 year-old children in Kwa-Zulu Natal South Africa:

An epidemiology study using the Dental Aesthetic Index (DAI)

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ABSTRACT

Introduction

The prevalence of malocclusion among school going children in KwaZulu-Natal remains poorly defined despite the known physiological and psychological impact of this dental occurrence.

Objectives

The aim and objectives of this study was to determine the prevalence of malocclusion and possible treatment need in 13-15 year-old school going children in Durban, Kwa-Zulu Natal.

Methods

This was a descriptive, cross-sectional epidemiological study conducted on 270 school-going children aged 13 to 15 years, in the Umlazi and Pinetown school districts. A two-staged clustered and systematic random sampling technique was used to draw the study sample.

Data was collected through an intraoral examination of occlusal status and the malocclusion and orthodontic treatment need was assessed through use of the Dental Aesthetic Index (DAI). Questionnaires were developed to collect information on the learners' health status and socio demographic profile.

Results

The results indicated that 144 (53.3%) of the 270 learners had DAI scores <25 (no abnormality or minor malocclusion not requiring orthodontic treatment); 26 learners (9.6%) had DAI scores of between 26-30 (definite malocclusion requiring elective orthodontic treatment); 59 learners (21.9%) had DAI scores of between 31-35 (severe malocclusion requiring orthodontic treatment); and 41 learners (15.2%) had DAI scores >36 (very severe or handicapping malocclusion requiring mandatory orthodontic treatment). There was an increase in the proportion of malocclusion in older children. The age group of 15 years old had a mean and standard deviation of 30.02+8.9 when compared to the age group 13 years old (27.76+12.17). The association between gender distribution and severity of malocclusion was found to be statistically significant (p=0.01).

Conclusion

The present study primarily indicated a significant prevalence of malocclusion in the identified children. Although 53.3% of children did not require treatment, 37.1% presented with severe and handicapping malocclusion. This suggests a definite and mandatory treatment need for this group of children. The study could provide useful baseline epidemiological data that could inform oral health planning on the prevalence of malocclusion and orthodontic treatment need for 13-15 year-old school going children in the identified geographical area.

Keywords

Malocclusion, orthodontic treatment need, Dental Aesthetic Index (DAI), epidemiology, children.

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INTRODUCTION

Malocclusion is a highly prevalent dental occurrence, with social and psychological impact that can have physical and economic implications for the individual.[1,2,3] Malocclusion can influence the quality of life, including functional ability, appearance and aesthetic self-evaluation, and inter

personal relationships,[4,5] and is also associated as an aetiological factor in sleep-related breathing disorders.[6,7,8]

The World Health Organisation (WHO) has included malocclusion under the heading of Handicapping Dentofacial Anomaly[9] which is defined as an anomaly which causes disfigurement or impedes function, and that treatment is required should the functional disability impact on the individual's well-being.[10,11] Malocclusion is listed as the third priority of oral health problems, after dental caries and periodontal disease, in children and young adults.[12,13,14]

The orthodontic status (prevalence of malocclusion) and treatment need of the population varies among different countries, as well as among the different age and gender groups within the respective populations.[15,16,17] Various orthodontic epidemiological studies have been conducted internationally[8,18] but there is a lack of published or recent data on the prevalence and severity of malocclusion and the orthodontic treatment need for children aged 13 to 15 years in KwaZulu-Natal.[19,20] Furthermore, very little has been done to quantify the proportion of the population that could benefit from orthodontic treatment[21,22] or identify measurement tools that could increase consistency and accuracy in the reporting methods.[23]

Occlusal indices are useful for research, audit, patient management and quality assurance in the treatment of malocclusion.[24,25] The epidemiological data on orthodontic treatment need is essential for the effective planning of dental education, dental public health programmes, training and deployment of dental manpower, screening for treatment priority and clinical treatment, resource planning and funding.[12,26,27,28] The increasing importance of appearance and dental aesthetics as well as functional concerns have increased the demands for orthodontic treatment at early ages[4,29,8,18] and as public interest in oral health care increases, so will the demand for orthodontic treatment.[30,31,13]

The Dental Aesthetic Index (DAI)

Different indices have been developed for various aspects of orthodontic care but these indices have not been uniformly adopted.[32,33] The Dental Aesthetic Index (DAI) was adopted as a cross-cultural index by the World Health Organisation (WHO) for assessment of orthodontic treatment needs.[34]

This index has been used by researchers for diverse communities and populations without the need to modify the index, and its clinical and aesthetic components (ACs) allows for a single score that can depict the physical and aesthetic aspects of the occlusion.[35, 36,19,37,38] The DAI index could therefore be used to identify orthodontic treatment need within different ethnic groups[24] or determine malocclusion rates and orthodontic treatment need in different countries.[26,39,40,41]

However the DAI does have some disadvantages. The reporting and scoring does not include important features such as cross-bite, midline deviation, or over-bite and may under-diagnose the need for orthodontic treatment.[42,43]

The DAI may under estimate the need for orthodontic treatment in cases where the canine is displaced and/or when the incisors are rotated or crowded. In cases of increased over-bite, the DAI may overestimate the treatment need when there is an increase in overjet, even in normally aligned teeth.[37,44]

Despite these clinically specific limitations, the DAI has been used in international collaborative studies[45] and has been used worldwide in epidemiologic studies of orthodontic treatment need in several industrialized and developing countries.[46,39] The index has been established as an essential armamentarium for the oral health care worker and epidemiologist.[47,3]

METHODS

This was a descriptive cross-sectional epidemiological study conducted in the Umlazi and Pinetown high school districts. The sample comprised of 270 school going children aged 13 to 15 year (n=270). A two-staged clustered and systematic random sampling technique was used to draw the study sample. A list of the schools was obtained from the KwaZulu-Natal Department of Education.

A traditional cluster design was used to create a group of 33 clusters with between four to eleven schools per geographical area. Eight learners per school were independently selected by a staff member in each of the identified school to reduce potential bias in participant selection. This provided a 95% confidence interval (CI). The inclusion criteria included male and female children attending the selected schools between the ages of 13 and 15.

Table 1. The components of the standard DAI regression equation and their actual and rounded regression coefficients (Weights).

DAI Component	Regression coefficient	
Weight	Actual weight	Rounded
Number of teeth missing visible teeth (incisors canines and premolars in the maxillary and mandibular arches).	5.76	6
Crowding in the incisal segments 0= no segment crowded 2=2 segment crowded.	1.16	1
Spacing in incisal segments: 0=no spaced 1=1 segment spaced 2=2 segment spaced.	1.31	1
Midline diastema in mm.	3.13	3
Largest anterior irregularity on the maxilla in mm.	1.34	1
Largest anterior irregularity on the mandible in mm.	0.75	1
Anterior maxillary overjet in mm.	1.62	2
Anterior mandibular overjet in mm.	3.65	4
Vertical anterior open bite in mm antero= posterior molar relation.	3.69	4
Largest deviation form normal either left or right: 0=normal. 1= half cusp either mesial or distal, 2=one full cusp or more. Either mesial or distal.	2.69	3
Constant.	13.6	18
Total:	DAI SCORE	

The exclusion criteria included the following: a child on orthodontic treatment or had a previous history of orthodontic treatment; a child with a known medical condition (a health questionnaire was administered to rule out any medical condition that could be exacerbated by the clinical examination); and where no parental consent or child assent was obtained.

Ethical clearance was obtained from the Biomedical Research Ethics Committee (BREC), University of Kwa-Zulu Natal. Gatekeeper permission was granted by the Kwa-Zulu Natal Department of Education. Permission was also obtained from the relevant school authorities and informed consent was obtained from parents or guardians of the participants. In addition, participant assent (child consent) were obtained prior to the study.

Data collection included a health questionnaire. A second questionnaire was used to collect socio-demographic information such as gender, age, school district (urban, peri-urban and rural), number of people in household, source of income, income level of parent, education level and access to dental treatment. All questions were closed-ended.

For calibration and pre-examination training, the researcher selected twenty study models of patients that underwent a full orthodontic examination and were representative of the age groups and types of malocclusion that were anticipated in the sample population. Three dental experts, who were familiar with the criteria for the different variables of the DAI evaluated each study model.

The independent scores obtained from this process were used as the gold standard for comparison with scores obtained in this study. The primary investigator in this study examined the twenty orthodontic study models within a five day interval and an adequate reproducibility index was obtained (k=0.91).

The research instruments was pre-tested in a pilot study among ten children attending a high school that was not on the selected school list. The questionnaires, clinical examination process and data capturing sheet were pre-tested to identify any challenges and corrective changes were made. All participants were examined by a single examiner. A full mouth clinical examination was conducted under natural light and disposable gloves, tongue blades, mouth mirror and Community Periodontal Index Probe were used.

The clinical examination was done according to the Dental Aesthetic Index (DAI), which is rank-ordered on a continuous scale to assess severity levels in order to prioritize treatment need. Each participant was examined and scored for the ten components of the DAI and this score was multiplied by its corresponding regression coefficient using the rounded weights (Table 1).

Data consisting of DAI components were recorded according to the WHO Oral Health Survey form.[34] Intra-examiner consistency was obtained by repeating the clinical examination for every 5th learner and the two scores for the same learner was compared. High levels of infection control was maintained.

The regression equation for obtaining a DAI score is:

DAI score = 6 (missing incisors, canines and premolars) + (crowding) + (Spacing) + 3 (diastema) + (largest maxillary irregularity) + (largest mandibular irregularity) + 2 (anterior maxillary overjet) + 4 (anterior mandibular overjet) + 4 (anterior open bite) + 3 (antero-posterior molar relationship) +13.[15,19,40,47]

Table 2. Malocclusion and severity levels

DAI score	Severity levels
<25	Minor or no anomaly: No treatment
26-30	Definite malocclusion: Elective treatment
31-35	Severe malocclusion: High desirable treatment
36-70	Handicapping malocclusion: Mandatory treatment

Table 3. Age and gender characteristics of the study population.

Age in years	Male		Female		Total	
	N	(%)	N	(%)	N	(%)
13	107	(39.6%)	37	(13.7%)	144	(53.3%)
14	31	(11.5%)	51	(18.91%)	82	(30.4%)
15	22	(8.1%)	22	(8.1%)	44	(16.3%)
Total:	160	(59.3%)	110	(40.7%)	270	(100.0%)

Table 4. Distribution of DAI components.

DAI	Males		Females		Total		P value
Components	N	(%)	N	(%)	N	(%)	
Missing anterior teeth							
0	122	(76.3%)	66	(60.0%)	188	(69.6%)	0.04
>1	38	(23.8%)	44	(40.0%)	82	(30.4%)	
Missing mand teeth							
0	125	(78.1%)	102	(92.7%)	227	(84.1%)	0.01
≥1	35	(21.9%)	8	(7.3%)	43	(15.9%)	
Incisal segment crowding							
0	115	(71.9%)	83	(75.5%)	198	(73.3%)	0.43
1-2	45	(28.1%)	27	(24.5%)	72	(26.7%)	
Incisal segment spacing							
0	94	(58.8%)	95	(86.4%)	189	(70.0%)	0.03
1-2	66	(41.3%)	15	(13.6%)	81	(30.0%)	
Midline diastema							
0	79	(49.4%)	93	(84.5%)	172	(63.7%)	0.04
1 to ≥3	81	(50.6%)	17	(15.5%)	98	(36.3%)	
Max. ant. Irregularity							
0	40	(25.0%)	46	(41.8%)	86	(31.9%)	0.03
>1	120	(75.0%)	64	(58.2%)	184	(68.1%)	
Mand. Ant. Irregularity							
0	40	(25.0%)	39	(35.5%)	79	(23.3%)	0.06
>1	120	(75.0%)	71	(64.5%)	191	(70.7%)	
Max. overjet							
0-2	33	(20.6%)	53	(48.2%)	86	(31.9%)	0.00
>2	127	(79.4%)	57	(51.8%)	184	(68.1%)	
Mand overjet							
0	154	(96.31%)	110	(100.0%)	264	(97.8%)	0.04
≥1	6	(3.8%)	0	(0.0%)	6	(2.2%)	
Ant. Open bite							
0	135	(84.4%)	77	(70.0%)	212	(75.5%)	0.05
≥1	25	(15.6%)	33	(30.0%)	58	(201.5%)	
Ant. Post- molar relation							
Normal	48	(30%)	30	(27.3%)	78	(28.9%)	0.22
Half cusp deviation	96	(60%)	61	(55.5%)	157	(58.1%)	
Full cusp deviation	16	(10%)	19	(17.3%)	35	(13%)	0.22

Each participant's DAI score was then placed along the dental aesthetic index continuum to determine their percentile score (Table 2). The points obtained from the regression equation were tabulated to a score for assessing the severity of malocclusion.

Two-way frequency tables for DAI groups by gender, age, location type were compiled. A log linear analysis was performed to investigate the interactions in these two-way tables. A p-value <0.05 indicated that the variables in that particular interaction term differ significantly.

If an interaction term was found to be significant, the nature of the interaction was further investigated by considering the parameter estimates and associated p-values for each interaction. The Chi-square test [X2] was used for comparison of severity of malocclusion. One way Analysis of Variance [ANOVA] test was used for comparison of mean DAI scores between the age groups and in DAI scores.

The 'Z' test was used to compare the mean DAI scores between gender groups. The DAI was dichotomized into ≤25 (no malocclusion) and, >25 (prevalence of malocclusion) to determine whether an association existed between the malocclusion and socio demographic variables. Post-hoc analysis was conducted between intragroup variables to determine significance values. The data was analysed using the Statistical Package for Social Sciences software [SPSS version 24].

RESULTS

The demographic characteristics of the study population (n=270) by age and gender is summarised in (Table 3). The results indicated that 160 (59.3%) of the study sample were boys and 110 (40.7%) were girls. Amongst 160 boys, 107 (39.6%) were in 13 years age group, 31 (11.5%) were in the 14 years age group, and 22 (8.1%) were in the 15 years age group. Similarly among the 110 girls, 37 (13.7%) were in the 13 years age group, 51 (18.9%) were in the 14 years age group and 22 (8.1%) were in the 15 years age group (Table 3).

The distribution of the DAI components by gender is presented in Table 4. Of the 270 children examined, 188 learners (69.6%) had no missing anterior maxillary teeth while 82 learners (30.4%) had one or more missing anterior teeth. Among 160 boys examined, 122 (76.3%) had no missing anterior teeth and 38 boys (23.8%) had one or more missing anterior teeth. Out of 110 girls examined 66 (60.0%) had no missing anterior teeth while 44 girls (40.0%) had one or more missing teeth. This difference between boys and girls was found to be statically significant (p= 0.04).

The results further indicate that 227 learners (84.1%) had no missing anterior mandibular teeth while 43 learners (15.9%) had one or more missing anterior teeth. Among the 160 boys examined, 125 (78.1%) had no missing anterior teeth and 35 boys (21.9%) had one or more missing anterior teeth. Out of 110 girls examined, 102 (92.7%) had no missing anterior teeth and 8 girls (7.3%) had one or more missing teeth. This difference between boys and girls was found to be statically significant (p=0.01).

A total of 198 learners (73.3%) had no incisal segment crowding and 72 learners (26.7%) had one or two segment crowding. No statistically significant differences in anterior segment crowding were observed in the study group (p=0.43) A total of 189 learners (70.0%) had no incisal segment spacing and 81 learners (30.0%) had one or two segment spacing. Incisor segment spacing when compared between the males and females was found to be statistically significant. (p=0.03).

Similarly statistically significant differences were observed in the occurrence of midline diastema. A total of 172 learners (63.7%) had no diastema and 98 learners (36.3%) had a diastema greater than 2mm (p=0.04). The anterior maxillary irregularity was significant when the prevalence was compared between males and females (p=0.03), however there was no statistically difference in the anterior mandibular irregularity (p=0.06).

When the prevalence of an anterior maxillary overjet (p= 0.00) and anterior mandibular overjet (p=0.04) was compared between the males and females, statistically significant differences were observed. Eighty-six learners (n=86, 31.9%) had no anterior maxillary overjet and 184 learners (68.1%) had an overjet of >2mm. Similarly, 264 learners (97.8%) had no anterior mandibular overjet, and 6 leaners (2.2%) had a mandibular (reverse) overjet of >2mm.

While 212 learners (78.5%) had no anterior open bite, 58 learners (21.5%) had an anterior open bite of >1mm. There was no statistical significant difference between males and females. In the antero- posterior molar relation, 78 learners (28.91%) had normal molar relationship, 157 learners (58.11%) had half–cusp deviation, and 35 learners (13.0%) had full–cusp deviation (p=0.22).

The prevalence of malocclusion and orthodontic treatment need according to the DAI for the sample population is categorised in Table 5. Of the 270 participants, 144 learners (53.3%) had DAI scores <25 (no abnormality or minimal malocclusion requiring no or slight orthodontic treatment), 26 learners (9.6%) had DAI scores of 26-30 (definite malocclusion requiring elective orthodontic treatment), 59 learners (21.9%) had DAI scores of 31-35 (severe malocclusion requiring highly desirable orthodontic treatment), and 41 learners (15.2%) had DAI scores >36 (very severe or handicapping malocclusion requiring mandatory orthodontic treatment).

Table 5. Prevalence of malocclusion and orthodontic treatment needs according to the DAI

No. of children affected N (%)	DAI score	Severity of malocclusion	Treatment need
144 (53.3%)	<25	No abnormality or minor malocclusion	No/slight need
26 (9.6%)	26-30	Definite malocclusion	Elective
59 (21.9%)	31-35	Severe malocclusion	Highly desirable
41 (15.2%)	≥36	Very severe malocclusion	Mandatory

The distribution of DAI scores and orthodontic treatment need according to age indicated that the age group of 15 year old learners had a mean and standard deviation of 30.02+8.9 when compared to age group 13 year old learners (27.76+12.17) and the 14 year old learners (26.27+11.63). The difference between age groups was not statistically significant (p=0.22) (Table 6).

The comparison of various international studies using the DAI is summarised in Table 7. The results of the current study reflect a mean DAI score of 27.67 at a 95% confidence interval (CI).

The gender distribution of the prevalence of malocclusion and orthodontic treatment need by categories of the DAI are depicted in Table 8. The mean and standard deviation were 28.93+11.6 for males and 25.85+10.744 in female learners respectively. This variation in the results were statistically significant (p=0.01).

The results of the association between and socio demographic variables and malocclusion as classified by the dichotomised DAI are depicted in Table 9. No significant differences were observed in the prevalence of malocclusion in the different school districts (urban, peri-urban, rural) (p=0.62), or in source of income (p=0.08). The prevalence of malocclusion and the learners' access to dental treatment (public or private health care) was statistically significant (p=0.02)

DISCUSSION

The Dental Aesthetics Index (DAI) establishes a list of occlusal traits in categories that are arranged in grades to allow observation of the severity of malocclusion and the orthodontic treatment need in an identified population. [37,38,48]

Table 6. Distribution of DAI scores and orthodontic treatment needs according to age.

Age in years	No. of children	DAI scores				
	No (%)	≤25n (%)	26-30n (%)	31-35n (%)	≥36 n (%)	Mean ± SD
13	144 (53.3%)	74 (51.4%)	13 (50%)	35 (59.3%)	22 (53.7%)	27.6±12.179
14	82 (30.4%)	55 (38.2%)	7 (26.9%)	8 (13.6%)	12 (29.3%)	26.27±11.633
15	44 (16.3%)	15 (10.4%)	6 (23.1%)	16 (27.1%)	7 (17.1%)	30.02±8.930

Table 7. Mean Dental Aesthetic Index score for other populations (International studies) and South Africa – Kwa Zulu Natal (Current Study).

Population (Reference)	Sample size	Age range	Mean DAI score	95% CI
Caucasians Americans[36]	1337	7-12	26.5	26.1-26.9
Native Americans[36]	485	7-12	31.8	-
Caucasians (S. Australia)[50]	5000	13	28.8	-
Australia[50]	309	10	26.6	23.3-24.9
Japanese[43]	409	15-18	30.5	29.731.3
Poles[53]	1000	12-13	24.5	-
Malaysians[39]	1512	12-15	24.6	-
South Africa[9]	5744	12	16.8	-
New Zealand[51]	150	13	26.7	-
Iranians[37]	900	12-1	23.5	23.1-23.9
Nigerian[21]	703	12-15	22.3	21.9-22.8
Indian (Himachal; Hill population)[38]	1188	9 and 12	19.9	-
Tanzania[49]	289	12-15	24.6	23.86-25.36
Brazil[48]	486	12-15	18.0	-
Indian (Maharashtra)[57]	880	12-15	20.0	-
Mongolia[58]	557	11-16	29.0	-
South Africa (Kwa-Zulu-Natal) (This study findings)	270	13-15	27.67	26.29-29.05

Table 8. Gender distribution of gender distribution of DAI scores and orthodontic treatment need.

Gender	No. of children	DAI scores			
No (%)	≤25 n (%)	26-30n (%)	31-35n (%)	≥36 n (%)	Mean ± SD
Male	160 (59.3%)	69 (47.9%)	18 (69.2%)	45 (76.3%)	28 (68.3%)
Female	110 (40.7%)	75 (52.1%)	8 (30.8%)	14 (23.7%)	13 (31.7%)
Total	270 (100.0%)	144 (100.0%)	26 (100.0%)	59 (100.0%)	41 (100.0%)

Table 9. Socio demographic variables and dichotomized DAI.

	No Malocclusion < 25		Malocclusion > 25		Total		P
	N	(%)	N	(%)	N	(%)	
1. School district							
Urban	57	(47.5%)	58	(36.8%)	155	(42.6%)	0.62
Peri Urban	60	(50.0%)	35	(23.3%)	95	(35.2%)	
Rural	3	(2.5%)	57	(38.0%)	60	(22.2%)	
2. Source of income							
Unemployed	0	(0.0%)	5	(3.3%)	5	(1.9%)	0.08
Employed	51	(42.2%)	76	(50.7%)	12	(47.0%)	
Self-Employed	68	(56.7%)	21	(23.6%)	89	(33.0%)	
Social Grant	1	(0.8%)	48	(98.0%)	49	(18.1%)	
3. Access to dental treatment							
Public Health (Clinic)	3	(2.5%)	122	(81.3%)	125	(46.3%)	0.02
Private Practice	117	(97.5%)	28	(18.7%)	145	(53.7%)	

Establishing the index's cross-cultural validation and duplicity is necessary because cultural standards regarding the position of teeth may differ from country to country, and the degree of attractiveness and treatment need also vary [26]. Rwakatema DS noted that although diastema mediale may be regarded as unaesthetic in western societies, it is considered as a sign of beauty by Tanzanians.[49] The mean DAI score of the present study was 27.67, and 53.3% of the children examined, had a dental appearance that required no orthodontic treatment (DAI score of <25). A definite malocclusion occurred in the remaining 46.7% of which a small number proportion of the study sample (n=26, 9.6%) fell in the category of elective treatment. This finding suggest that that 37% of learners examined, required definitive orthodontic treatment. The literature further suggest that children may not be aware of their orthodontic need for treatment due to poor dental knowledge, or inadequate access to treatment due to socio economic constraints or non-availability of treatment services.[44,9]

The components that primarily contributed to the variation in DAI scores in this study population were spacing in the incisal segments, diastema, largest anterior irregularities in the maxilla and mandible, maxillary overjet and anteroposterior molar relationship. These findings are similar to those reported in studies from Australia,[50] Malaysia,[39] New Zealand[51] and Nigeria.[21]

The number of children not requiring orthodontic treatment (53.3%) was consistent with a previous study conducted by van Wyk and Drummond (53%)[19] but these findings were lower when compared to 12-13 year old Malaysian children (62.5%)[39] and 12-18 year old Nigerian children (77.4%).[21] However the mean DAI score (27.67) of this study is much higher than the previously reported South African study, (16.8)[20] as well as that of the Nigerian study (22.3)[21] and Tanzanian study (24.6).[49] This difference could possibly be explained in that the previous South African survey was a national survey compared to the current study and that younger learners were included in the previous sample. It could also be suggested that there is an increasing prevalence and severity of malocclusion in the 13 to 15 year old learners. The distribution of DAI scores and orthodontic treatment need according to age indicated an increase in the proportion of malocclusion in the 15 year old children, (although there was no statistical significance between the age groups).

These results are in contrast to van Wyk and Drummond[19] who reported a high prevalence of malocclusion in the 12 year old group and a decline in the 15 year old group. A possible explanation could be the developmental differences due to the late mixed dentition stage that could aggravate the prevalence and severity of dentofacial anomalies. The current study focused on learners from age 13 and as such the malocclusions could have been possibly more established as defined by the components of the DAI.

There was a higher prevalence of females (40%) with missing anterior teeth as compared to males (23.8%). A greater number of males had spacing in the incisal segments (41.3%) and diastema (50.6%) as compared to females with 13.6% with spacing, and 15.5% with diastema respectively. The presence of a diastema in the developing dentition at age 12 is regarded as a normal phenomenon.[52] In the absence of a deep overbite, these spaces normally close spontaneously.[52] If the space between the maxillary central incisors is greater than 2mm, spontaneous closure is unlikely.[52] A diastema of 2mm and greater, occurred more in males (28.8%) than in females (9.1%). The presence of anterior irregularity in the maxilla (68.1%) and mandible (70.7%) occurred more in males than in females. The presence of increased maxillary overjet (28.9%) was higher in males than females. These results are higher than the Tanzanian study (12%)[49] and Nigerian study (14.1%)[21] but closely comparable to the South African study (29.65%).[19]

The mean DAI score of the present study (27.67) was higher than that of Caucasian Americans,[36] Australians,[50] Malaysians,[39] New Zealand,[51] Poles,[53] Iranians,[37] Tanzania[49] and Indian populations.[38] The scores were lower than that of Native Americans[36] and Caucasians Australians.[50] These differences could be due to different sample sizes and/or inclusion of younger and older age ranges. The differences could also be attributed to genetic predisposition, variation in growth and facial skeleton development, and occlusion due to population type.

The mean DAI score for males was (28.93) and females (25.85). The analysis of gender distribution of DAI scores and orthodontic treatment need revealed that males were found to have greater treatment need than females. This corresponds with other South African and Nigerian studies that found girls tend to have lower mean DAI scores than boys.[19,21,49] These gender differences in the DAI score should be interpreted with caution. The differences in dental development stage could contribute to the differences in the DAI representation for boys and girls.

No significant differences where observed in the distribution of malocclusion by school district (p=0.62). The results of the current study suggest that planning and provision of orthodontic services for urban, peri-urban and rural areas should not be prioritised differently. The prevalence of malocclusion by employment status (p=0.08) and income of parent (p=0.49) showed no statistical differences but the results suggested an association between the prevalence of malocclusion and access to dental treatment (p=0.02). These results possibly suggest that learners who had previous access to private health care to minimise caries and tooth loss had lower malocclusion scores.[54] Another possible explanation is that dental practitioners could have undertaken systematic serial extractions to alleviate crowding and thus contributed to lower incidence of malocclusion.[55]

These findings could provide reliable base-line data regarding the prevalence and severity of malocclusion as well as useful epidemiological data on the orthodontic treatment need of 13 to 15 year-old children in the identified geographical areas in Durban. As both the general dental health and socio-economic status of the population of South Africa improve together with the "globalization" and awareness of dental aesthetic needs, it is foreseeable that the number of children seeking orthodontic treatment will also increase.[56] It should be noted that 'interceptive orthodontic' programmes can reduce the

severity of the problems but rarely is so successful that later treatment becomes unnecessary.[52] Orthodontic services should therefore be comprehensive and appropriate to the specific needs of the individual.[52]

CONCLUSION

This study provided useful base-line epidemiological data on the orthodontic treatment need of 13-15 year-old South African children in the selected geographical areas in Kwa-Zulu Natal and could make a contribution to oral health planning and policy decisions in the province.

Conflict of interest

None.

Acknowledgement

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South Africa's contribution in the field of Forensic Odontology
- A textbook review

SADJ August 2021, Vol. 76 No. 7 p422 - p423

LM Sykes[1], L Robinson[2]

Textbook of Forensic Odonto-Stomatology
International Organization of Forensic Odonto-Stomatology (IOFOS)

Editor: Hrvoje Brkić
Co-editors: Rüdiger Lessig, Ricardo Henrique Alves da Silva, Vilma Pinchi, Patrick Thevissen
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This textbook represents an up-to-date, comprehensive compilation of the field of Forensic Odontology. The chapters have been uniquely structured to take the reader through all aspects of this discipline in a methodical and logical approach. Authors for each section were carefully selected as being internationally recognised experts and renowned amongst their peers in their particular field of Forensic Odontology.

The material in this textbook is presented in a manner that is both interesting and clear for novices in the discipline, while at the same time offering highly informative, cutting-edge information for experts practising Forensic Odontology. The book begins with a chronology of the origin of Forensic Odontology dating back to 1477, using intriguing real-life cases to set the theme for the rest of the book.

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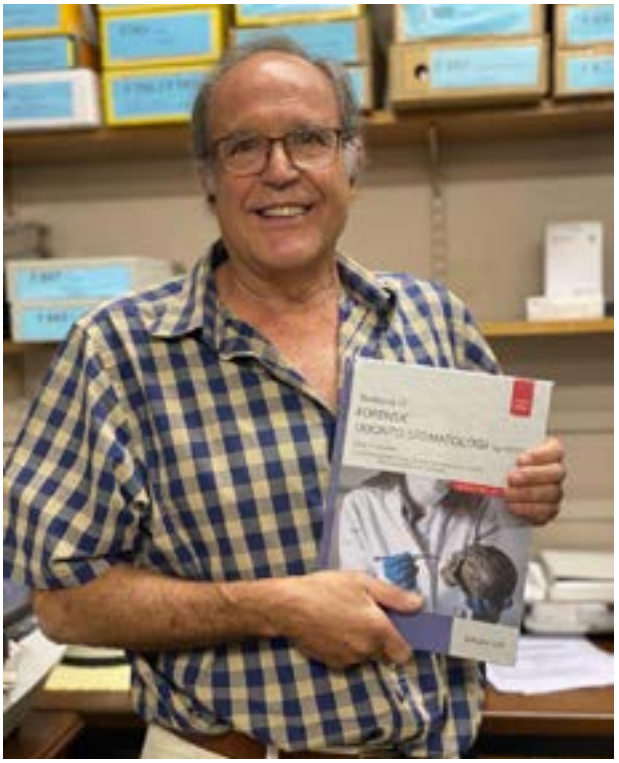
2. **Liam Robinson:** Co-author - 50%

Chapter 2 was written by Professor Herman Bernitz (Department of Oral Pathology and Oral Biology, University of Pretoria) and is not for the faint-hearted. He presents a finely detailed and vividly illustrated working guide on mortuary procedures associated with victim identification. One cannot read this chapter without having a true admiration for him and his Forensic Odontology team at the University of Pretoria.

The book then takes the reader through the practical aspects of forensic dental identification, including dental charting, radiology and photography. It then delves into the scientific aspects of DNA analysis and dental age estimation. A section is dedicated to dental profiling, heredity and acquired dental anomalies, and teeth in an-



Professor Herman Bernitz (*BChD, Dip (Odont), MSc, PhD.*) holding a copy of the *Textbook of Forensic Odonto-Stomatology.*

cestry, including their use in gender determination. One chapter has been included on cheiloscopy and rugoscopy – the analysis of unique lip and the palatal features in victim identification, a concept similar to more commonly used fingerprinting methods.

The following four chapters are dedicated to victims of mass disasters, human abuse and facial trauma. Once again Professor Bernitz compiled the well-researched chapter on bitemark collection and analysis, based on his years of experience and international regard in this intriguing and often much-deliberated field of Forensic Odontology. It is a discipline that has developed from humble beginnings using only macroscopic analysis, to the cutting edge addition of metric, microscopic and more recently three-dimensional analyses.

These chapters on human violations lead well into the next sections covering expert witness presentation, the use of information technology, and quality assurance in Forensic Odontology. They are a reminder to all clinicians on the importance of keeping accurate and thorough dental records, and the necessity to safeguard these in the event that they may be needed at some stage in the future. It is also a reminder to resist the urge to elaborate with personal emotions and opinions in patients' files and records, as only verifiable and factually correct information is acceptable in a court of law.

The penultimate chapter covers the fascinating art and science of facial approximation and reconstruction. The authors are so confident that this textbook will inspire and stimulate everyone who reads it to delve deeper into the fascinating field of Forensic Odontology, that they dedicated a final section on how one can further their education and qualifications in Forensic Odontology.

If you are interested in the field of Forensic Odontology, we strongly recommend reading the "Textbook of Forensic Odonto-Stomatology by IOFOS". We are fully confident that once you pick up the book you will be so captivated that you will not be able to put it down until you have bitten into and devoured every single page. Congratulations Professor Bernitz on this momentous achievement and your contributions in the field of Forensic Odontology!

Do the CPD questionnaire on page 435

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

SADJ August 2021, Vol. 76 No. 7 p426 - p430

Compiled and edited by V Yengopal

1. XP-endo Shaper versus conventional rotary files in oval canals with necrotic pulps: a randomized clinical study

RS Emara, SI Gawdat, HM El-Far. Effect of XP-endo Shaper versus conventional rotary files on postoperative pain and bacterial reduction in oval canals with necrotic pulps: a randomized clinical study. International Endodontic Journal; 2021; 54: 1026-36.

INTRODUCTION

Endodontic files are used to remove intracanal pulpal tiss ues, microbial biofilm, and toxic by-products and to develop a continuously tapering canal while maintaining the canal geometry that ultimately allows for the delivery of irrigating solutions and intracanal medicaments as well as the three-dimensional filling of the root canal system.[1] Historically, stainless steel hand files have been used to perform canal shaping. However, these files are stiff and associated with increased operator fatigue, and when used in the preparation of curved root canals, the restoring forces of the files tend to return the file back to its original shape, resulting in canal transportation.[1]

More recently, nickel-titanium (NiTi) files have been introduced and are broadly used to shape the root canals owing to their increased flexibility, rapid and centered canal preparation, safer preparation of curved canals, improved cutting efficiency, and improved treatment outcome.[1] In spite of all these advantages, the main limitation in the use of a NiTi file is the risk of their fracture, especially when it is autoclaved and reused.

XP-Endo Shaper is a single-file system that is used in a continuous rotary movement. This file is snake-shaped with a triangular cross-section. It has an apical diameter of 0.27 mm and a fixed taper of 0.01. The MaxWire technology involved in the production of this file provides it with superelasticity and shape memory properties that makes it ideal for use in both straight and curved canals.

Emara and colleagues (2021)[1] reported on a trial that sought to evaluate whether root canal instrumentation using XP-endo Shaper in comparison with conventional rotary instrumentation using iRaCe files would result in a difference in postoperative pain, and intracanal bacterial count in mandibular premolars with single oval canals and necrotic pulps.

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MATERIALS AND METHODS

This study was designed as a parallel, randomized, double blinded clinical trial. The inclusion criteria for the participants were healthy men and women of 20-60 years reporting no to mild preoperative pain and having mandibular premolars with single oval root canals and necrotic pulps, and with (smaller than 3 mm) or without periapical radiolucency. The exclusion criteria were pregnant women, if analgesics or antibiotics had been consumed by the patient during the past 12 h, teeth that did not have a normal occlusal contact on verification using an articulating paper, association with acute periapical abscess, greater than 5mm periodontal pockets, greater than grade I mobility, alveolar bone loss exceeding 50%, and non-restorable teeth.

The diagnosis was confirmed through history of chief complaint, negative response to both thermal test and electrical pulp tests and radiographic examination using the digital imaging. After opening the access cavity to confirming the diagnosis by absence of bleeding, each patient selected an envelope and was allocated either to the XP-endo Shaper group (A) or the iRaCe group (B). The patients and outcome assessors were blinded to the assigned treatment group throughout the study.

Each patient was given pain scale chart (modified visual analogue scale) to record the presence and severity of pain before treatment. The modified VAS consisted of 10 cm line and was illustrated visually, verbally and numerically to the patients. Four categorical scores expressed the pain level: 1, None (0); 2, Mild (1–3); 3, Moderate (4–6); 4, Severe (7–10). Root canal treatment was completed in a single visit using a standardized approach in both groups. After local anaesthesia and application of rubber dam, the

access cavity was then prepared using another sterile round carbide bur and Endo-Z bur under sterile saline irrigation. The operative field and pulp chamber were disinfected and 5% sodium thiosulfate was used to neutralize the effect of NaOCl then dried using sterile cotton wool. Sterility was checked by collecting control samples from the external surface of the crown as well as the access cavity using sterile paper points and culturing them aerobically and anaerobically.

Stainless steel size 15 K-files were used to confirm the patency of the root canals. Working length was determined using an electronic apex locator then confirmed radiographically to be 0.5 mm shorter than radiographic apex. In the intervention group, the Xp-endo Shaper single file was used for instrumentation in an endodontic motor at a speed of 800 rpm and a torque of 1 Ncm starting at size 30, .01 taper. The file was operated in 5 up and down strokes of 3-5 mm amplitudes until reaching working length then 10 brushing strokes of 5-7 mm for the full length of the canal and an extra 45 s of instrumentation was continued at the working length to enlarge the canal to size 40, .04 taper. After each 5 strokes, the canal was irrigated using 3 mL of 2.5% sodium hypochlorite and EDTA gel was used as a lubricant. In the control group, mechanical preparation was completed using rotary iRace files sizes 15, .06 taper, 25, .04 taper, 30, .04 taper, and 40, .04 taper at a speed of 600 rpm and a torque of 1.5 Ncm and the canal was irrigated after the use of each instrument.

All canals received the same volume of irrigant (30 mL) using a syringe with 27 gauge open ended bevelled needle placed at 3 mm from the working length. The canals were then dried using sterile paper points and flushed with 5 mL of 5% sodium thiosulfate to inactivate the NaOCl. The final preparation was then checked by adapting master cones of size 40, .04 gutta-percha at the working length and a radiograph was taken to verify proper length. The post-instrumentation root canal samples (S2) were then taken from the canals. The microbiological samples were transferred to the laboratory. Canal filling was completed using a modified single cone technique with a resin-based root canal sealer. The access cavities were restored with core-build up composite resin and occlusal contacts were adjusted.

Patients were asked to record the incidence and severity of their postoperative pain on the modified visual analogue scale (VAS) at 6, 12, 24 h, 2, 3, 4, and 5 days. The patients were prescribed Ibuprofen (400 mg) to be consumed in case of persistent moderate to severe pain. Patients recorded the incidence and number of analgesic tablets taken.

Intracanal bacterial counts were determined using a culture technique and the resultant growth was visually quantified by counting the number of colony forming units per millilitre (CFUs/mL) under the microscope. Only plates with 30-300 colonies were counted.

If swelling occurred, the patient was seen to assess the severity by a blinded assessor on a four point swelling rating scale expressed as none (n); small swelling intraorally adjacent to the treated tooth (s); moderate (m); or large severe swelling visible extraorally (l) The blinded assessor also determined if systemic antibiotics (Augmentin 625 mg/8 h/5 days) or drainage were needed. The incidence of flare-up was recorded as a binary outcome (Yes/No) when patients reported moderate to severe postoperative pain and/or moderate to severe swelling that began 12-48 h after treatment and lasted at least 48 hours.

RESULTS

Sixty patients were included in the statistical analysis. The demographic data and clinical features of the patients were similar in both groups.

The incidence of postoperative pain was significantly lower in the intervention group compared with the control group at 6, 12 and 24 h (P=0.039, 0.047, and 0.026, respectively). The mean postoperative pain scores were lower in the intervention group at all follow-up periods with a significant difference at 6 h (mean difference: 1.33, 95% CI: 0.307-2.352, P=0.02), 12 h (mean difference: 1.1, 95% CI: 0.263-1.936, P=0.007), 24 h (mean difference: 0.94, 95% CI: 0.178-1.701, P=0.008) and 48 h (mean difference: 0.97, 95% CI: 0.192-1.747, P=0.038).

There was a significant decrease with time in mean pain scores at all evaluation periods in relation to preoperative pain in the intervention group (P=0.01 at 6 h and <0.001 at 12 h, and 1-5 days) while in the control group a significant decrease in mean pain scores occurred at 3 to 5 days evaluation periods (P=0.9 at 6, 12, 24 h, 0.37 at 2 days, and <0.001 at 3-5 days).

There was no significant difference in the incidence of analgesic intake (3.3% in the intervention group versus 16.7% in the control group [P=0.085]). Regarding number of analgesic tablets in the intervention group, 1 patient took 2 tablets; while in the control group, 3 patients took 2 tablets and 2 patients took 3 tablets with no significant difference between them (P=0.08).

All sterility control samples were negative for bacterial growth. Both groups were associated with a significant reduction in the bacterial counts following canal instrumentation compared to pre-instrumentation samples with no significant difference between them. S2 anaerobic bacteria counts represented 16.31% of S1 (i.e. 83.68% reduction) in the XP-endo Shaper group, and 19.48% of S1 (i.e. 80.5% reduction) in the iRaCe group. The number of root canals free of cultivable anaerobic bacteria were 8 (26.67%) in the XP-endo shaper group and 3 (10%) in the iRaCe shaping group. There was a weak correlation between postoperative pain severity and anaerobic bacterial counts (rs=-0.079, P=0.54).

Flare-ups occurred in 2 cases in the control group in the form of moderate swelling occurring 24 h after treatment and lasting for 48 h. Flare-ups were controlled by systemic antibiotics with no need for drainage or retreatment. No flare-up occurred in the intervention group. The overall incidence of flare-up was 3.3%.

There was no correlation between age and postoperative pain (rs=0.111, P=0.39) nor preoperative and postoperative pain (rs= 0.085, P=0.51). None of the clinical variables (i.e. gender, presence or absence of periapical lesion)

had a significant effect on neither incidence nor intensity of postoperative pain ($P > 0.39$).

CONCLUSIONS

XP-endo shaper significantly reduced the incidence (at 6, 12, and 24 h) and severity (at 6, 12, 24, and 48 h) of postoperative pain compared with iRaCe rotary files. Both instrumentation systems succeeded in significantly reducing bacterial levels in primary infected root canals with no significant difference between them.

Implications of practice

The XP-endo shaper system performed significantly better for the outcomes post-operative pain than the rotary system.

Reference

1. Emara RS, Gawdat SI, El-Far HM. Effect of XP-endo Shaper versus conventional rotary files on postoperative pain and bacterial reduction in oval canals with necrotic pulps: a randomized clinical study. International Endodontic Journal; 2021; 54: 1026-36.

2. Ultrasonic versus laser-activated irrigation during root canal treatment: a randomized clinical trial

D Liapis, MA De Bruyne, RJ De Moor, MA Meire. Postoperative pain after ultrasonically and laser-activated irrigation during root canal treatment: a randomized clinical trial. International Endodontic Journal. 2021; 54: 1037-50.

INTRODUCTION

Mechanical canal instrumentation and irrigation with antibacterial solutions constitute the basis of root canal treatment. Irrigating solutions are crucial in order to flush away debris, remove the smear layer and further disinfect the noninstrumented areas of the root canals.[1] Sodium hypochlorite (NaOCl) is the most commonly used irrigant, due to its antimicrobial and antibiofilm potency and organic tissue dissolution capacity. However, it has been shown to be cytotoxic to the periapical tissues.

Irrigation with a syringe and a needle remains the most commonly used technique for irrigation in endodontics but fluid penetration at the apical region is limited. Efforts to surmount this problem have been made via the introduction of various irrigant activation devices or methods to improve irrigant distribution within the root canal system and augment disinfection. Sonic and ultrasonic agitation techniques are being used, but other forms of activation such as laser-activated irrigation (LAI) and manual-dynamic activation (MDA) have also been introduced more recently.[1]

Ultrasonically activated irrigation (UAI) implies the ultrasonic activation of irrigant in the centre of the instrumented root canal by a noncutting, oscillating instrument. The working mechanism primarily is the generation of steady, unidirectional circulation of fluid in the vicinity of the vibrating instrument, called acoustic microstreaming.[1] Laser-activated irrigation (LAI) with a pulsed Er: YAG laser is another method of irrigant activation. Pulsed erbium lasers produce optical cavitation in the irrigant, resulting in expanding and imploding vapour bubbles at the fibre tip and smaller secondary bubbles deeper in the canal that undergo acoustic streaming.[1] These events occur extremely rapid (within the microsecond region), resulting in very fast liquid movement throughout the entire canal. However, there have been reports of irrigant extrusion with LAI leading to possible post-operative pain. Laipas and colleagues (2021)[1] from Belgium reported on a randomized controlled trial that sought to compare the postoperative pain after ultrasonically (UAI) and laser-activated (LAI) irrigation in asymptomatic patients undergoing primary root canal treatment. The null hypothesis was that there is no significant difference in postoperative pain after root canal treatment using UAI or LAI.

MATERIALS AND METHODS

This was a double-blind, single-centre, superiority parallel design randomized controlled trial which was reported in accordance with the Preferred Reporting Items for Randomized Trials in Endodontics (PRIRATE) 2020 guidelines.[1] Healthy patients over the age of 18 years who required root canal treatment of an asymptomatic tooth with vital or necrotic pulp, or with a previously initiated therapy on the emergency dental department, with or without radiographic apical rarefaction, were considered for enrolment.

Patients were excluded if they had pain, a history of sensitivity or adverse reactions to any of the medications (nonsteroidal anti-inflammatory drugs) or materials used in this study. Teeth with incompletely formed roots or open apices, retreatment cases or patients presenting with pain in another area and/or tooth of the oral cavity or patients who took medication that could alter pain perception (e.g. analgesics) within at least 12 h before treatment were also excluded, as well as pregnant or breastfeeding females.

Medical and dental history of every individual was recorded, and clinical and radiographic examination was performed. Clinical examination included visual inspection of the tooth and surrounding tissues, assessment of restorability, periodontal probing, palpation and percussion tests. Sensibility testing was done using cold test.

Periapical radiographs were taken using the parallel technique. This information resulted in establishment of the pulpal and apical diagnosis. Each patient was asked to determine the level of preoperative pain by drawing a line on a VAS (0–100 mm), with 0 meaning 'no pain' and 100 'unbearable pain'. Healthy patients indicating a level of pain between 0 and 4 mm on the VAS were asked to participate in the study.

Complete chemo-mechanical preparation and canal filling were performed by the same operator in a single visit using a standardized approach. The working length (WL) was determined by an electronic apex locator. After initial shaping, the final apical preparation size of each canal was determined as 3 sizes larger than the first binding file at the WL, using hand files. The canal preparation was completed using ProTaper Next (PTN) instruments, with a minimum apical diameter of size 25. Irrigation was done using a 27-gauge notched needle adapted to a 3mL syringe with 2 mL of 3% NaOCl in between instruments. The needle was inserted to a depth of 2-3 mm short of WL. Before the final irrigation procedure, each canal was rinsed with 2ml EDTA 17%.

Patients were then randomly assigned to one of the two groups based on the supplementary irrigation protocol: group A (UAI) and group B (LAI). It was ensured that both the patient and the operator were unaware of the assigned treatment protocol until completion of chemo-mechanical preparation. Due to the nature of the interventions, the operator could not be blinded. The assigned treatment protocol was not revealed to the patient. The data collector was also blinded.

Prior to the final irrigant activation, the root canals and the pulp chamber were filled with 3% NaOCl. In the *UAI group*, an Irrisafe file, driven by an ultrasonic handpiece at 30% intensity, was used for 3 × 20 s. The file was held at 1-3 mm from WL (pre-curved in curved canals) avoiding wall contact. In between each activation cycle, each canal was rinsed with 2 mL of 3% NaOCl using a 27G needle adapted to a 3cc syringe.

In the *LAI group*, an Er: YAG laser with a wavelength of 2940 nm was used. The pulse energy was 20 my, pulse frequency 15 Hz and pulse length 50 µs. The laser tip was held above the root canal entrance and two activation cycles of 30 s were done per canal, with an intermediate rinse with 2 mL 3% NaOCl. During activation, the pulp chamber was continuously replenished with 3% NaOCl. All procedures were performed by an experienced operator.

The canals were then dried using paper points and filled with gutta-percha and an epoxy resin sealer (AH Plus) using the continuous wave of compaction technique. A bonded flowable composite was placed as a barrier above the orifices, and a small Teflon piece was placed above the composite. The access cavity was then temporarily sealed with glass–ionomer (Fuji IX GP Capsule). Thin remaining walls or unsupported cusps were reduced in height and occlusion was adjusted in order to stabilize the remaining tooth structure. A postoperative periapical radiograph was taken for each tooth. Each patient was given a prescription of ibuprofen 400 mg.

Each patient received a pain diary to record their pain on the following moments: 6, 24, 48 and 72 h after the intervention. A visual analogue scale (0-100 mm) was used to indicate the pain intensity. The VAS was thoroughly explained to the patients, who were then instructed to place a mark on the horizontal VAS line corresponding to the intensity of postoperative at the various moments. The time at which the treatment was finished was written on the pain diary to facilitate the completion of the pain record. Patients were advised to use the prescribed medication only if they felt that pain was affecting their normal life. The pain diary also contained a part to keep a record of their analgesic intake.

Patients were instructed to return the reports either via post, via email or at their next visit at the dental school. When reports were sent via email, the pictures were printed. Measurements were done using a ruler and when necessary, the rule of three was used to determine the level of pain.

RESULTS

A total of 88 subjects were initially screened for inclusion, and 56 patients were finally enrolled in the study. The random allocation resulted in 28 patients (18 males and 10 females) in the UAI group and 28 patients (13 males and 15 females) in the LAI group. Fifty-five patients returned their VAS forms, one patient from the UAI group failed to do so. The mean age of the patients in the UAI group was 41 years, whilst in the LAI group, it was 43 years. Ten teeth in the UAI group and 15 teeth in the LAI group displayed a preoperative radiolucency. There were no significant differences between the two arms regarding gender (P=0.179), age (P=0.712) and the presence of an apical radiolucency (P=0.179).

Overall, mean postoperative pain intensity was low (overall mean of 9.4 after 6 h and 6.55 after 24h), with the majority of patients having no or minimal pain 24 h postoperatively. Six hours postoperatively, pain intensity was significantly lower in the LAI group compared to the UAI group (P<0.05). Whilst this difference was statistically significant, it was below the value considered as clinically relevant, as determined in the power calculation. At 24, 48 and 72h, no statistically significant differences between the activation groups were observed (P>0.05).

In the UAI group, the pain at 24 h was significantly lower than the pain at 6h (P< 0.05). At 48 and 72h, the pain levels were significantly lower compared with the preceding time interval. In the LAI group, the mean postoperative score at 24 h was slightly higher than that at 6h, but this difference was not significant (P>0.05). At 48 and 72 h, a further significant decrease compared to the previous time-points was noted (P<0.05).

One patient from the UAI group reported severe pain up to 78 mm on the VAS till 48 h postoperatively. This case was associated neither with swelling nor with an emergency visit. No other untoward effects were reported.

Logistic regression analysis of the incidence of postoperative pain revealed a significant association between the presence of postoperative pain at 6 h and the final irri-

gation protocol, whilst no association was observed with age, gender, tooth type and presence of radiolucency.

Six hours after treatment, 26% of the patients (7 of 27) in the UAI group and 7,7% (2 of 28) in the LAI group required analgesics for pain control, but this difference was not significant. No significant differences in analgesic intake between the two groups were found at the other time intervals

CONCLUSIONS

Ultrasonically and laser-activated irrigation resulted in low and comparable levels of postoperative pain in asymptomatic patients receiving primary root canal treatment.

Implications for practice

These new modes of irrigant administration show promise for routine clinical application compared to the current needle and syringe method for the outcome of lower post-operative pain.

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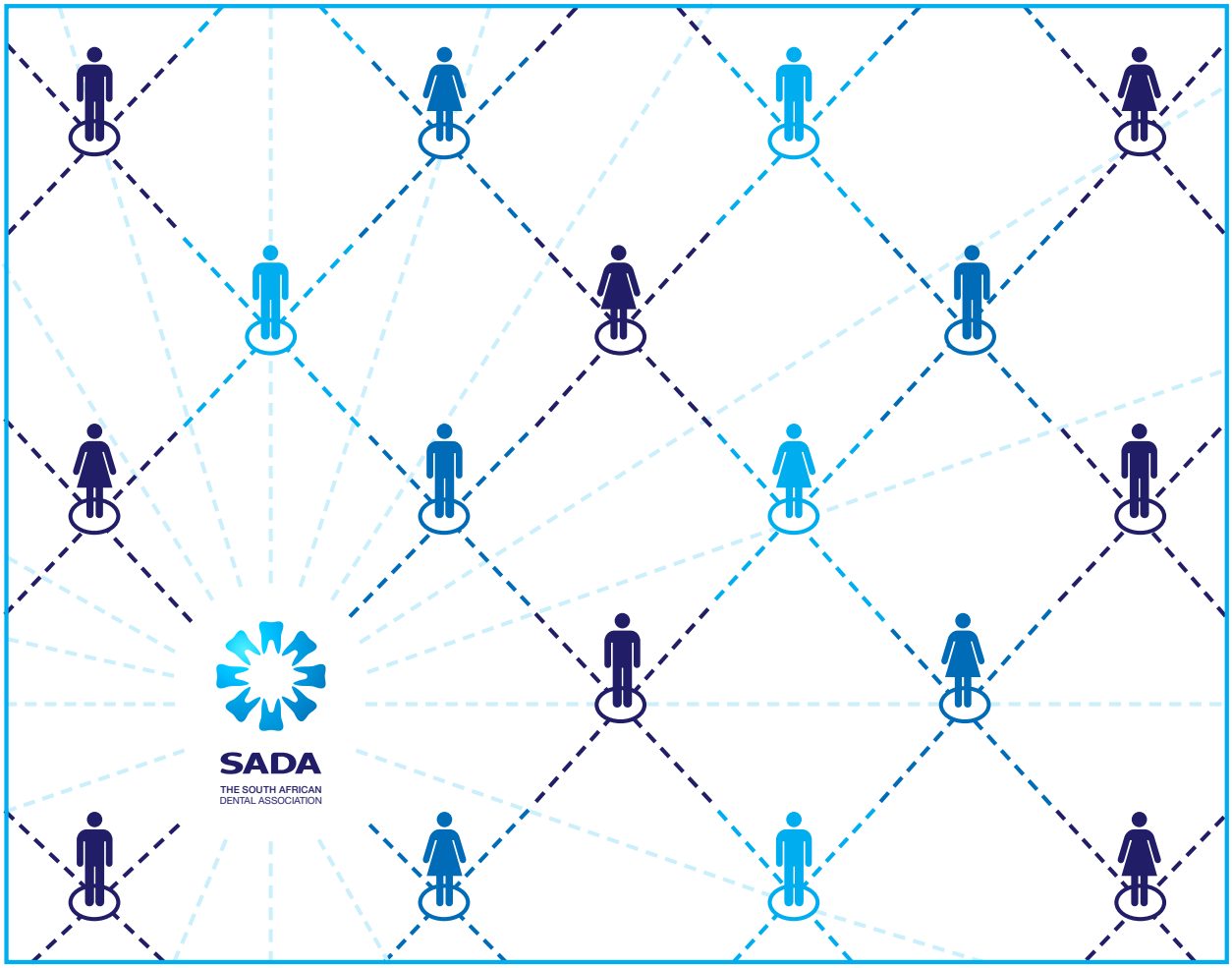
1. Liapis D, De Bruyne MA, De Moor RJ, Meire MA. Postoperative pain after ultrasonically and laser-activated irrigation during root canal treatment: a randomized clinical trial. International Endodontic Journal. 2021; 54: 1037-50.



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Maxillofacial Radiology 192

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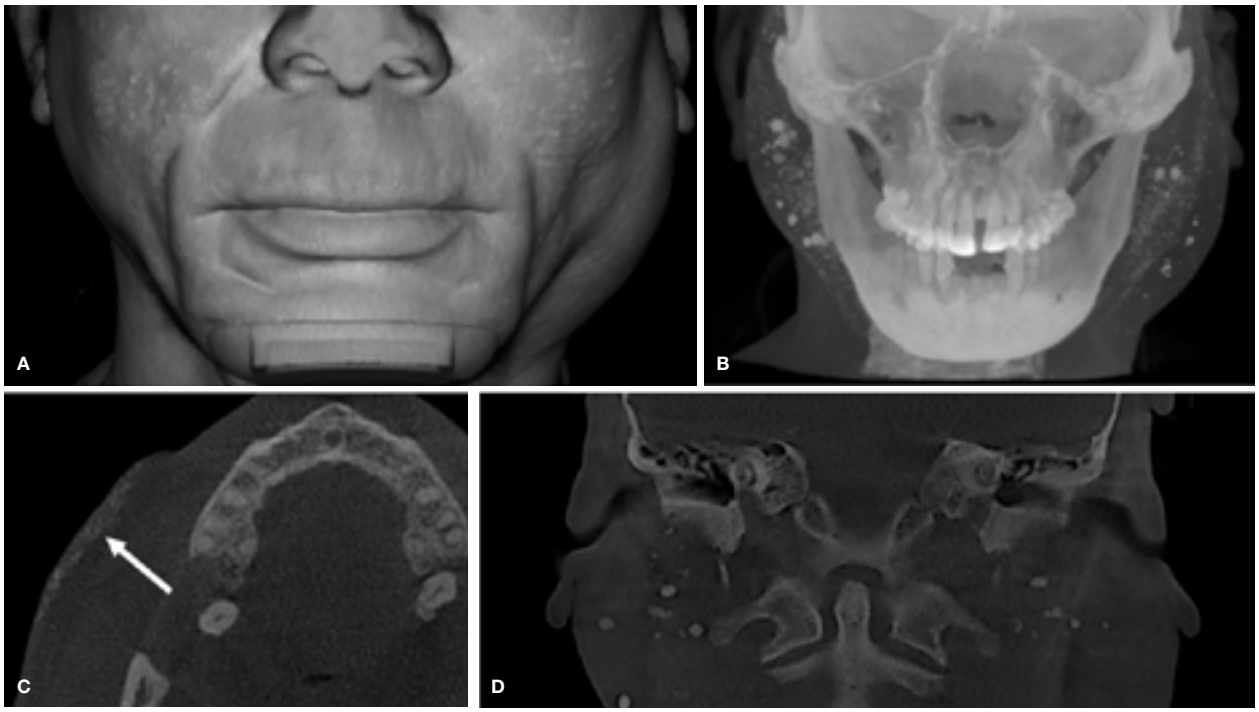
C Nel[1], L Robinson[2]

A 64-year-old male patient, who is human immunodeficiency virus (HIV) positive on treatment, presented with a two-year history of a painful swelling involving the left parotid gland. Cone beam computerised tomographic (CBCT) imaging was performed (Figures A-D). What are the pertinent radiological findings and your diagnostic hypothesis?



INTERPRETATION

Cone beam computerised tomographic (CBCT) imaging showed extensive calcifications of various sizes involving the superficial and deep lobe of both parotid glands. Additionally, superficial dermal calcifications (arrow) caused by dystrophic calcifications from chronic skin conditions such as acne were noted. Dystrophic calcifications occur in chronically inflamed or necrotic tissue, whereas metastatic calcifications are due to metabolic disturbances leading to elevated serum calcium levels. The localised nature of the calcifications, limited to the parotid gland, rules out a metastatic form of calcification. Calcifications in the major salivary glands are classified as intraductal (limited to or obstructing the duct) or intraparenchymal.[1]

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Multiple intraparenchymal parotid calcifications have been reported in association with Sjögren syndrome (23%) and human immunodeficiency virus (HIV) disease (15%). These calcifications often present as multiple punctate calcifications of various sizes, and are often associated with symptoms of swelling and intermittent pain.[1] Non-neoplastic HIV-associated salivary gland diseases include benign lymphoepithelial lesions, cystic lymphoid hyperplasia and diffuse infiltrative lymphocytosis syndrome (DILS).[2] Salivary hypofunction, xerostomia and diffuse gland enlargement are also commonly reported. Diffuse parotid calcifications in association with HIV can be contributed either due to the salivary gland dysfunction caused by the disease itself or due to highly active antiretroviral therapy (HAART).[2]

Patients presenting with multiple bilateral parotid calcifications, in the absence of metabolic disturbances, should be investigated for autoimmune parotitis or HIV infection.

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Technicians and Dentists:
A catch 22 situation?

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LM Sykes[1], C Bradfield[2], GP Babiolakis[3], L Becker[4]

ABSTRACT

Dental technicians who regularly receive poor quality impressions and records are often faced with professional and ethical concerns as to how to handle the situation. They may choose to complete the task to the best of their abilities. Other options are to alter the casts to try to improve the situation and then complete the prescription, contact the dentist and discuss the issue, contact the patient, contact the medical aid, report the practitioner to the HPCSA, or refuse to do the work.

Their latter actions have potentially negative implications for them, and will certainly sour working relationships. At worst, they may lose the dentist's support. This paper explores ways in which dentists and techniciains can foster collegial and mutually beneficial relationships from early on in their careers. This will not only promote better communication, and improve the quality of work produced by them, but it will also serve the best interests of their patients and the profession as a whole.

INTRODUCTION

A previous paper[1] explored the challenges dental technicians face when they are sent poor quality work and asked (instructed) to complete the case.

In addition to the many responses presented in that paper, more technicians have come forward with further ethical challenges that they are struggling to find answers to. Their main concern, and the focus of this paper is the welfare of patients. Technicians may receive poor quality work from the dentist and even identify situations where adjacent teeth have been badly damaged, based on the pre-operative study models (if these exist). Figure 1 illustrates a case where the technician poured a cast from a very poor impression. It clearly shows mandibular anterior teeth with advanced alveolar bone loss, that are more than likely also mobile, as they have been splinted.

The accompanying instructions were for the technician to do a diagnostic wax up as the dentist planned to place crowns on these teeth. The technician felt very uneasy with the proposed treatment. Cases like these raise several professional and ethical concerns that put technicians in a difficult position on how to handle the situation.

Figure 1. Cast showing splinted mandibular anterior teeth with exposed roots.

Concerns

The technician may feel that the patient has been badly treated and would like to alert them to this. However, the dentist will argue that the clinical situation was more complex than the models suggest, which necessitated additional tooth structure being sacrificed.

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Technicians know that indirect restorations made on poorly prepared teeth will not meet professional standards and are doomed to fail, and yet they are still being expected to spend (waste) their time fabricating these restorations. This goes against the ethics of fair distributive justice.[2,3]

They may be concerned that the patient could suffer further harm if these restorations fail. The "harm" in this sense may include pain, discomfort, embarrassing aesthetics, the inconvenience of needing to have the work re-done, additional time and financial costs, and even possible tooth loss.

The dentist and patient could blame the technician for the failures and technicians have no way to prove that this was not the case. Also, they are often expected to re-do the work at their own expense, which can be a substantial time and financial burden.

Possible actions

1). Their first line of action will be to carry out the work to the best of their abilities. They will most likely feel uneasy about this and constantly be on edge about the possibility that the case will fail within a short period.

Some have even resorted to "altering the casts" to try and improve them and then completing the case. Their anxiety and moral conscience may well rule out this option.

2). Secondly, they could contact the dentist and discuss the case. If it is a once-off they may be able to reach a compromise and will probably try their best to remedy the situation together.

3). If it is a repeat occurrence it becomes a bigger concern, especially if the dentist has been approached and does not improve, or if the dentist refuses to accept that his/her work is substandard. In this case, can/should they inform anyone else, and if so, who?

a). Can a technician contact the patient directly and tell them about their reservations? Do they have a right to do this seeing as their primary client is the dentist and not the patient? However, the "end-user' is the patient and they will be the ones who suffer. Could they be sued by the dentist for defamation of character if they do talk to the patient?

b). Should the technician rather contact the medical aid and tell them that this clinician repeatedly sends poor quality work and perhaps hope the medical aid will investigate the number of times they get "double accounts" for work on the same patient. It may also reveal if the dentist may be fraudulently submitting the second account with different tooth numbers to ensure they get paid, which is an even greater offense and can have medico-legal consequences.

c). Should they report the practitioner to the HPCSA and if so on what grounds? Rule 26 of the Councils relates to reporting of "impaired "colleagues. However, "bad work" is not necessarily an impairment, and how can they prove this if the patient doesn't complain?

d). They may refuse to do the work and ask that it be sent to another laboratory.

Potential implications

The ethical technician who feels they have a moral duty to serve the best interests of the patients, to protect the reputation of the profession, and to maintain high standards of care may find himself or herself in a quagmire. They now have to weigh up the risks of acting according to their conscience and in the best interest of the patients, against many possible negative consequences.

The concerned technician will not be able to turn a blind eye to bad work for any length of time and will have to make a difficult decision on how to move forwards. In the second scenario where an amicable and favorable solution was reached; the outcomes and consequences will be beneficial to all parties.

In the third case, they risk angering the clinician and will probably lose the work. They may also not get sent any future work, which will compromise their livelihood.

If they contact the patient, not only will they lose work, but could open themselves up for a hefty lawsuit that could be difficult to defend. They also have no way of knowing how the patients will react to their communication and interference. There is even a risk that the patients will support the dentist, in which case they will have no grounds of justification!

Contacting the medical aids may alert them to be vigilant when assessing future claims from these practitioners. However, from an ethical standpoint, it is also somewhat self-serving and won't appease their conscience. They are still completing the work, and still ensuring they get paid for it, yet the patient is still going to be affected if it fails. Thus they cannot declare that they have acted in the best interest of THAT patient.

A further risk they need to consider very carefully is their livelihoods. The dental community is small and word of their actions will become known to other clinicians very quickly. They could find themselves being blacklisted from receiving any work from all other clients especially practitioners who worry that their work may be scrutinized and reported on.

Possible solutions?

While it is easy and tempting to criticize the work of colleagues, one needs to remember that there may have been unknown, adverse circumstances that influenced the outcomes. Nobody can produce perfect work all of the time. There will be occasions when even the best dentist or technician may produce work that the other party feels could be improved upon. The issue arises when the pattern is repeated. After discussion with other experienced technicians, they suggest to perhaps keep sending unsatisfactory work back to the dentist.

This will allow them to uphold their oath to "do no harm",[6] and be at peace with their conscience knowing that they have served the patient's best interest. The patient may

also start to question the dentist's ability to perform the work as the impression has to be continually repeated, which may in turn force the dentist to improve to avoid an embarrassing situation. However, they may lose the work in the process, and the dentist will probably continue to carry out and deliver inferior quality work.

It would be far better for all parties if dentists and technicians develop a good relationship of understanding and mutual trust and respect from the onset. They need to both appreciate the limitations and difficulties that may be encountered, as well as know what can realistically be accomplished in any given case.

Both professions need to think of possible solutions. If we don't take this on, nothing will get done and the situation will never change (or improve). A practical constructive and a mutually beneficial solution will be to implement common teaching platforms at the undergraduate level.

Technicon students could do a rotation period at one of the 4 dental schools. Here they will be allocated to a group of students for whom they will be required to carry out the laboratory work. Ideally, they will accompany their peers to the clinical wards where they will be able to appreciate some of the challenges a clinician faces. These include issues such as difficult working position, mouth access, navigating a mobile tongue, saliva, bleeding, limited mouth opening, material manipulation, difficult patients, communication problems, time constraints, and unforeseen dental complications.

While it is primarily the duty of the dentist to manage these difficulties adequately, it will help them understand why impressions and work are sometimes unsatisfactory and why it may require.additional effort to obtain an acceptable outcome. They will also have a clearer idea of issues to discuss with the clinician if they are uncertain or unhappy.

At the same time, dental students can accompany their "partner" to the laboratory and observe the technical aspects of dental technology being performed on their very own patient cases. This should help clarify and consolidate their knowledge about why certain clinical requirements and mouth preparations are needed. They will also develop more realistic expectations of what can be achieved in the dental laboratories and learn how to communicate their instructions comprehensively and understandably.

We must strive to instill a culture of dentists and technicians being a united team, from an early stage in career development, and that we need each other and need to work with each other. Understanding each other will allow both parties to produce better work in the future.

Perhaps the movement to digital technology where clinicians scan, design and make indirect restorations themselves, will allow them to appreciate the difficulties a technician may have with unsatisfactory preparations and impressions. Some software programs also have a "prep checker" which can be used to analyze the preparation and provide an "unbiased evaluation" of it. This too enables clinicians to assess their work at the chairside and make the necessary corrections within that same visit.

Conclusions

This paper highlights the need to develop an ethos where dentists and technicians have a convivial relationship and are willing and able to discuss cases openly, and reach workable solutions or at the very least, an appropriate compromise.

They should also be willing to give and receive constructive criticism with the spirit that it is intended. This will not only improve the quality of work they produce and deliver but will help ensure the best possible outcomes for their patients. A win-win-win situation.

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CPD questionnaire

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

GENERAL

The accuracy of various radiographic modalities for implant therapy

1. Select the CORRECT answer.
   The investigation showed which of the following?
   A. CBCT showed higher accuracy in the maxilla and mandible measurements compared to panoramic and periapical radiographs
   B. CBCT showed inferior accuracy in the maxilla and mandible measurements compared to panoramic and periapical radiographs
   C. CBCT showed inferior accuracy only in the maxillary measurements compared to panoramic and periapical radiographs
   D. CBCT showed higher accuracy only in the mandibular measurements compared to panoramic and periapical radiographs

2. Which of the following statements is CORRECT and true?
   A. Measurements done at the maxillary sites showed more accuracy compared to the mandibular sites on periapical radiographs
   B. Measurements done at the maxillary sites showed more accuracy compared to the mandibular sites on panoramic radiographs
   C. None of the statements is correct
   D. Both of the statements are correct

3. Which of the below options is CORRECT regarding these two statements? Panoramic and periapical radiographs showed accurate measurements at individual sites; but, the overall differences indicated inferior dimensional accuracy compared with CBCT.
   A. Both statements are correct
   B. None of the statements is correct
   C. The first statement is correct, the second is false
   D. The first statement is false, the second is correct

4. Select the CORRECT statement:
   A. According to some reports, a submillimeter radiographic measurement error is still tolerable during implant treatment
   B. Submillimeter radiographic measurement error is not tolerable for complex implant treatment
   C. Radiographic measurement error for implant planning and placement is acceptable to within 2%
   D. None of the above statements is correct

An overview of COVID-19 infection in dental practices – a questionnaire survey

5. Select the CORRECT statement regarding transmission of COVID-19:
   A. It can be transmitted through saliva droplets
   B. It can be transmitted through the oral-faecal route
   C. It can transmitted through the ocular mucosa
   D. It can be transmitted thought the nasal cavity
   E. All of the above

6. Select the CORRECT answer. The risk for cross-infection in the dental office is high due to:
   A. exposure to dental aerosols
   B. close proximity to patients
   C. exposure to biological fluids
   D. potential surface contamination
   E. All of the above

7. Select the CORRECT statement regarding COVID-19 and infection control in dental settings:
   A. The infection rate of dentists in South Africa is lower than in other countries
   B. It is difficult to evaluate the effectiveness of the adopted infection control measures in dental office
   C. There is a lot of data on COVID-19 infections in dental practices
   D. PPEs measures are not critical for infection control
   E. None of the above

8. Select the CORRECT statement regarding treatment of COVID-19 patients in the dental practices:
   A. In South Africa, less than 10% of dental practices have treated laboratory confirmed COVID-19 patients
   B. It can be challenging to find the true origin of a patient's infection
   C. The occupational COVID-19 risk of dentists and dental staff has been estimated to be low when treating COVID-19 patients
   D. Asymptomatic carriers of COVID-19 do not increase the infection risk of dental practitioners and staff
   E. Quick COVID-19 tests should never be used in dental practices

Rice vinegar removes *Candida albicans* from denture acrylic resins

9. Select the CORRECT answer. Rice vinegar was as effective as apple cider vinegar, white wine vinegar and chlorhexidine in removing both *Candida albicans* strains from acrylic resin at:
   A. 1 hour
   B. 30 minutes
   C. 8 hours
   D. None of the above

10. Which of the following options is CORRECT? The following disinfectant was the most effective in removing both strains of *C. albicans* from acrylic resin at all tested times:
    A. Rice vinegar
    B. Apple cider vinegar
    C. White wine vinegar
    D. Chlorhexidine

11. Select the CORRECT answer.
    Sterile water was ineffective in completely removing both *C. albicans* strains from acrylic resin at:
    A. 30 minutes
    B. 1 hour
    C. 8 hours
    D. All of the above

12. Select the CORRECT answer.
    The advantages of vinegar include:
    A. Low cost
    B. Low toxicity
    C. Easy accessibility
    D. All of the above

13. Which of the options is CORRECT? The removing ability of Chlorhexidine for *C. albicans* ATCC strain at all tested times was:
    A. 80%
    B. 100%
    C. 99%
    D. 90%

Clinical Window: What's new for the clinician?

14. Select the CORRECT answer. In the Emara et al. trail, the following was found:
    A. The incidence of postoperative pain was significantly lower in the intervention group compared with the control group at 6h
    B. The incidence of postoperative pain was significantly lower in the intervention group compared with the control group at 6 and 12h
    C. The incidence of postoperative pain was significantly lower in the intervention group compared with the control group at 6, 12 and 24h
    D. None of the above

15. Which statement is CORRECT?
    When 2 groups or interventions are compared, statistical significance that implies one group or intervention is superior to the other is usually denoted by:
    A. $P > 0.05$
    B. $P < 0.05$
    C. $P = 0.05$
    D. $P > 0.1$

16. Select the CORRECT answer. When 2 groups or interventions are compared, statistical non-significance that implies one group or intervention is equivalent to the other is usually denoted by:
    A. $P > 0.05$
    B. $P < 0.05$
    C. $P = 0.05$
    D. $P > 0.1$

17. Which is the CORRECT option. In the Laipas et al. trail, the both groups had similar postoperative pain levels at the following time intervals:
    A. 6h
    B. 24h and 48h
    C. 6, 24, 48 and 72h
    D. 24, 48 and 72h

Maxillofacial radiology 192

18. Select the CORRECT answer. Which of the following is not a causative factor for multiple calcifications limited to the parotid gland?
    A. Sjögren syndrome
    B. HIV-associated salivary gland disease
    C. Metastatic calcifications
    D. Highly active antiretroviral therapy (HAART)

Radiology Case Report: Gardner syndrome

19. Which of the options is INCORRECT?
    HIV-associated salivary gland disease may present with all of the following conditions, except:
    A. benign lymphoepithelial lesions
    B. diffuse infiltrative lymphocytosis syndrome (DILS)
    C. Sjögren syndrome
    D. cystic lymphoid hyperplasia

20. Select the INCORRECT option.
    All of the following conditions are seen in increased frequency in HIV-associated salivary gland disease, except:
    A. intraductal calcifications
    B. diffuse glandular enlargement
    C. Xerostomia
    D. salivary gland hypofunction

ETHICS

Technicians and Dentists: A catch 22 situation?

21. Choose the CORRECT answer.
    Distributive justice includes:
    A. Not wasting skills or resources
    B. Fair allocation of resources to all
    C. Provision of health care according to patients financial position
    D. All of the above
    E. Only A and B above

22. Which of the following options is CORRECT?
    If a technician is unhappy with the work they receive, they should:
    A. Modify the casts and complete the work to save patients time and inconvenience
    B. Complete it to the best of their abilities to save patients time and inconvenience
    C. Use cheaper materials in case the job needs to be re-done
    D. Only A and B
    E. None of the above

23. Select the CORRECT answer.
An 'Impaired" clinician is one who:
A. has any form of physical disability
B. has any disability that affects their quality of work
C. has any form of mental disability
D. has both mental and physical disabilities
E. has any disability that nobody knows about

24. Select the CORRECT answer.
"Harm" to patients may include:
A. pain and discomfort
B. embarrassing aesthetics
C. time and financial wastage
D. Only A and C
E. All of the above

25. Which of the following statements is CORRECT.
Responsibility for the final restoration lies with the dentist, thus technicians
A. need not concern themselves if the work is poor
B. should rather post comments on social media than contact patients directly
C. should not question the dentist's abilities
D. None of the above
E. All of the above

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