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Winston Churchill



Upper Denture



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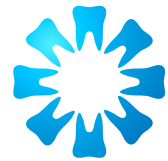




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## CONTENTS

## EDITORIAL

Balanced achievement - *WG Evans* 3

## COMMUNIQUE

2019 will only be different if you make it to be! - *KC Makhubele* 6

## RESEARCH

Comparison of the effect of fixed and variable taper on the volume of obturation material - *AOA Hassan, IE Munshi, S Tootla* 8Oral health status among Nyaope users at drug rehabilitation clinics in Johannesburg - *A Tetarwal, V Yengopal, I Munshi, R Meel* 13A comparative analysis of traditional dental screening versus teledentistry screening - *S Bissessur, S Naidoo* 19

## REVIEW

Research misconduct and publication ethics: a South African perspective\* - *R Ballyram, A Nienaber* 24

## CASE REPORT

Unusual intraorbital foreign body impactions, a case report - *GP Mohotlhoane, M Mabongo* 32

## CLINICAL WINDOW

What's new for the clinician - excerpts from and summaries of recently published papers - *V Yengopal* 35

## ETHICS

Non-maleficence – a disremembered moral obligation 40

Our Front Cover for this Issue...

Teeth have on occasion been central to historical, social and humorous events. The **Front Cover** in 2019 will reflect some of these **Famous Teeth**.

**Winston Churchill:** Churchill wore a partial upper denture carrying four incisors. He had a characteristic lisp, which made his voice instantly recognisable. Imagine "Fight on the beaches...." delivered without the front teeth! It is claimed that "these really are the teeth that saved the world". - Jane Hughes, Head of Learning, Hunterian Museum



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# CONTENTS

<b>RADIOLOGY CASE</b>	
Maxillofacial Radiology 167 - <i>CJ Nortjé</i>	43
<b>CONTINUOUS PROFESSIONAL DEVELOPMENT</b>	
CPD questionnaire	44
<b>AUTHOR GUIDELINES</b>	
Instructions to authors	46
<b>CLASSIFIEDS</b>	
www.sada.co.za - Smalls advertising placement procedure and rules	48

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# Balanced achievement

SADJ February 2019, Vol. 74 No. 1 p3 - p4

WG Evans



*“Extreme is easy.. balance is hard.” - Colin Wright, author.*

I look out the window and see one of our hanging flower pots precariously suspended at a severe cant...one of the supports has given way. Fixing will require restoring balance, a component critical in life.



Of particular regret to me, as an academic, has been the deletion of a promise that appeared in the 1923 Loeb edition:

*“To hold my teacher in this art equal to my own parents; to make him partner in my livelihood; when he is in need of money to share mine with him;”*

I am sure that many colleagues would cheerfully recommend the reinsertion of that clause! But it is not there that we focus... for the next phrase embodies some deeply relevant admonitions :

*“ to consider his family as my own brothers, and to teach them this art, if they want to learn it, without fee or indenture; to impart precept, oral instruction, and all other instruction to my own sons, the sons of my teacher, and to indentured pupils who have taken the physician’s oath...”*

The modern version administered to Faculty of Health graduates at the University of the Witwatersrand includes this commitment :

*“That I will not employ any secret method of treatment, nor keep secret from my colleagues any method of treatment that I may consider beneficial.”*

So we are enjoined to share knowledge freely without expectation of recompense in any form. Is it then a little ironical that the phrase “Publish or Perish” has become such a powerful incentive in academe? The scramble to be first to publish a new concept is well understood ...but that automatically implies that the details may have to be kept secret until the printed word announces the innovation.

Do we recognise a slight paradox? How many patients may have benefitted from the new knowledge whilst the researcher waited to first have the paper published?

A thoughtful paper in the pages of this issue debates aspects of research misconduct and inter alia explores another facet of this equation... as for example ...whilst under pressure to publish, a researcher “steals” the concepts of a colleague... formally stated as: the appropriation of another person's ideas, processes, results, or words without giving appropriate credit. In its worst form this is described as Plagiarism. I used the word “equation” for that implies that there should be a balance, one side against the other.

The paper on research misconduct handles the problem with precision, providing clear guidelines on how to avoid the traps. The Journal has a defined responsibility to ensure that all publications satisfy the strict criteria



The Hippocratic Oath loomed large at the end of last year when new graduates in the healing arts solemnly committed to balance the age old principles of good practice with their extracurricular lives. The oldest partial fragments of The Oath date to about 275 AD whilst the oldest complete version is held in the Vatican Library, thought to be from the 10th-11th century.

The most frequently cited version may be one dated to 1595, which appears in Koine Greek with a Latin translation. Of course the Oath has undergone several modifications over the years.

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and it is appropriate that we sincerely acknowledge the work and commitment of our panel of reviewers who are largely tasked with judging the papers submitted. Their contribution cannot be overstated ...and our indebtedness to them is considerable.

Perhaps at this time of the year our thoughts turn to resolutions... often a self promise on improving performance. It may have been in Babylon that the practice first arose. At the beginning of their year (actually March) they held a prolonged celebration over twelve days, known as Akitu, when promises were made to the gods that debts would be paid and any borrowed articles would be returned. That was some 4,000 years ago ...but resonates.

The Romans also had a custom of resolutions ...in January, named after the god Janus, he with two faces looking forward and backward... in one direction back over the old year, the other contemplating the new.

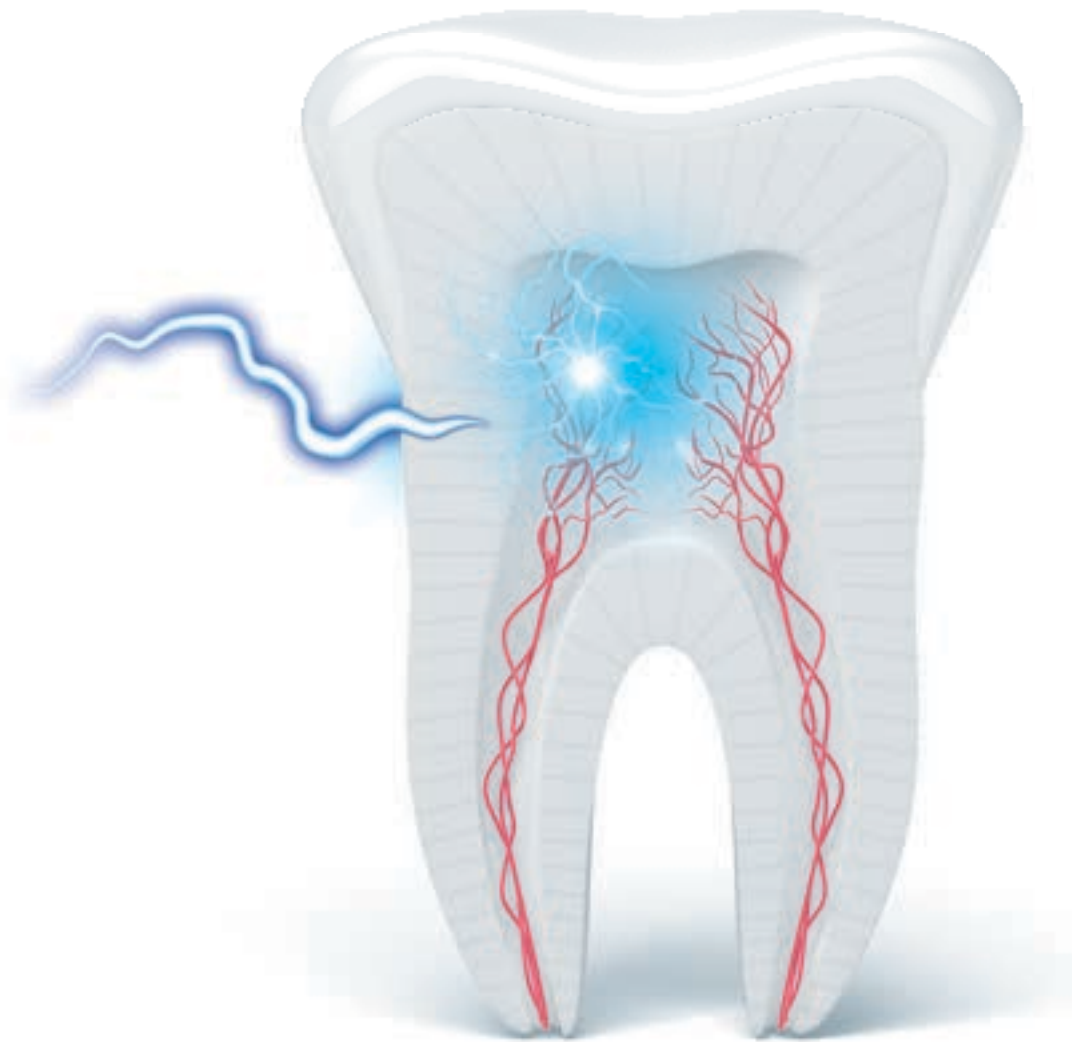


A good omen for contemplative resolution making! But contemporary research has shown that probably only 8% of resolutions are kept! And many are simply repeated year after year.

Perhaps it is time to restore balance, not only to our flower basket, but to all our endeavours... whether striving to avoid voids in root canal obturation, to understand the afflictions of drug dependence, to explore new technologies to assist community oral health... all considered in this first issue of 2019! Every best wish for a balanced year of achievement!



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# 2019 will only be different if you make it to be!

SADJ February 2019, Vol. 74 No. 1 p6 - p7

KC Makhubele



2018 has come and gone and many of us are going to swear to ourselves that we'll finally hit the gym, stop eating carbs, take our business to new heights and spend more time with our families! Unfortunately, as we have seen in past years, again and again, our deeply ingrained habits often supersede our good intentions, and we fall back into the same old habits within weeks.

I see this at the gym. I am Group Exercise Instructor at Virgin Active and from the third week of January my classes are always full to a level which at times is undesirable, but the classes return to normal at the end of February. In fact, studies show that only between 8% and 11% of people end up achieving their New Year resolutions.

I personally don't make New Year resolutions, but I have a continuous system of objectives setting and review. May I suggest that instead of focusing on these resolutions, perhaps we can aim to raise our level of self-consciousness? Let's reflect and evaluate what is and isn't working in creating a happy and fulfilling life. As we start afresh this New Year, here are four questions to contemplate.

## What kind of people are you attracted to and are attracting?

Birds of the same feathers flock together. It's possible that you need to change your "flock" in order for you to achieve some of your desired goals and objectives in 2019 and beyond.



KC Makhubele: Chief Executive Officer

For this you need to examine who you're drawn to, and who you're attracting – there's rich and telling information there waiting for you in such an analysis. Tyler Perry has a useful analogy of a tree to describe three types of people in our lives:



### The Leaf People:

They are only there for a season. You can't depend on them or count on them because they are weak and only there to give you shade. Like leaves, they are there to take what they need and as soon as it gets cold or the wind blows in your life they are gone.

### The Branch People:

They are stronger than leaves, but you have to be careful with them. They will stick around through most seasons, but if you go through a storm or two in your life it's possible that you could lose them. Most times they break away when it's tough. Although they are stronger than leaves, you have to test them out before you run out there and put all your weight on them. In most cases, they can't handle too much weight.

### The Root People:

Like the roots of a tree, they are hard to find because they are not trying to be seen. Their only job is to hold you up and help you live a strong and healthy life. If you thrive, they are happy.

They stay low key and don't let the world know that they are there. And if you go through an awful storm, they will hold you up. Their job is to hold you up, come what may, and to nourish you, feed you



and water you. We all need more of the root people for they are the source of nutrients, support and anchoring. Evaluate what kind of people you surround yourself with and what value they add to your life. Do they make you a better person? Similarly what kind of a person are you to others who's lives you are in.

You also need to ask if the people generally want your time, or are you the one usually chasing people for their time? If you are a person that sucks energy from people they will usually be repulsed from you.

Are you the one that's generally seeing the cup as half empty, seeing everything as negative, complaining, dumping your problems, asking what others are doing for you, judging, and/or interacting in an ego-state with a sense that you are the best all the time?

If you make it an intention to leave people feeling more inspired, understood and special after each interaction, you will find that more and more people will gravitate to you because you breathe life into them, versus sucking it out. In the end, the only thing people will remember about you is how you made them feel.

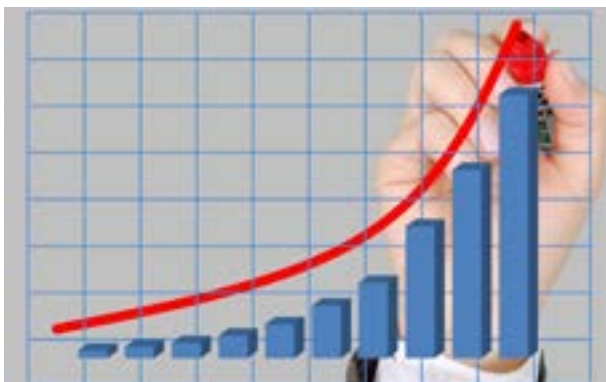
You need to translate all of these to your social space (family, friends, church, social club etc.) and your workplace (the surgery, the Hospital, the University etc.).

### Are you going to accept mediocrity or strive for greatness?

Success begets success. But everyone has to make a conscious decision as to what they choose to stand for and what they will accept as their standard. Why is it that one dentist is more successful than the other? We have to all agree that nothing great in life has ever been the result of minimal effort and a mediocre company.

Scott Alexander says that "All good is hard. All evil is easy. Dying, losing, cheating, and mediocrity is easy. Stay away from easy". I say: stay away from easy and the road well travelled. It's time to raise your bar, create your own path, follow your own dreams but know the difference between the pursuit of excellence and the obsession for perfection.

The world is changing around you and the opportunities are expanding. If you don't dare to expand the parameters of what you think is possible, you will not realize your potential. You need to take a calculated risk that can take you to new heights.



### Is fear controlling you and shaping your journey?

We all have our own bad experiences from the past but we should never allow it to ruin the good experiences ahead. We must welcome and see the great opportunities the world has for us, amidst all the challenges, instead of being in a state of constant defence, layered with armour to protect us from what may, or may not, happen. The armour itself is slowing you down and impeding your movement forward.

Do not let the fear of yesterday take away the joy today. Stop waiting for the other shoe to drop – it is the root cause of much unnecessary anxiety. Many people who have been successful in life have learned to leave the fear behind. The stress and negative energy you are creating through fear do nothing for your situation or the world around you except to cause you to be overburdened by things you may not have control of. Rather move forward and if things fail or fall apart, deal with the problem then.

Just as in the past, carry on with life, live life and if something should go wrong trust that you will have the ability, tenacity and strength to deal with the situation at hand – at that moment. Don't let fear cause you to stagnate and die slowly or fail to reach for your goals.

### Do you have goals?



We all know that setting goals helps you focus. Without goals, one will always go where the wind blows. Knowing where you want to go helps you to work backwards, to work out the time and resources needed and gives you the best chance at success.

It has been proven that if one bothers to set goals, the chances of success are 10x than those without objectives. Even better, if one goes further and writes the goals down, the chances of success are 3x more than those who keep their goals only in their mind.

Goals hold you accountable and become the yardstick of achievement. They are there to help you achieve and exceed your expectations. They serve to remind you what is important every day. So HAVE GOALS!

# Comparison of the effect of fixed and variable taper on the volume of obturation material

SADJ February 2019, Vol. 74 No. 1 p8 - p12

AOA Hassan<sup>1</sup>, IE Munshi<sup>2</sup>, S Tootla<sup>3</sup>

## INTRODUCTION

Cleaning and shaping of the root canal system are critical steps in endodontic procedures to create adequate space to enable irrigation solutions to reach areas that are inaccessible to instrumentation, to thereby reduce irritants and to facilitate the obturation of the root canal space.<sup>1,2</sup> Inadequate management of the root canal system may result in uninstrumented areas not being sealed by the obturating material.<sup>3</sup> Appropriate shaping of the root canal creates an apical resistance which reduces extrusion of the filling material beyond the apical foramen and creates a wider coronal third which will facilitate movement of irrigation solutions.<sup>4</sup>

Shaping the root canal system can follow three different configurations. Traditionally, the root canal was prepared to the full working length.<sup>5</sup> The flaring (fixed tapered preparation) technique was advocated in 1974 to improve the prepared shape of the root canal system.<sup>4</sup> In 2000, Buchanan<sup>6</sup> introduced the concept of variable tapered root canal preparation, where the diameter of the root canal increases progressively towards the coronal third.

Concomitantly, endodontic instruments have been through several eras of development, one of the most significant being the introduction, and ongoing modification of, the Nickel Titanium (NiTi) rotary file.<sup>7</sup> According to Haapasalo and Shen (2013)<sup>8</sup> the first generation design was introduced in 1992 by McSpadden<sup>7</sup> who developed the 2% tapered file. Subsequently, 4% and 6% tapered files were introduced, the cutting performance was improved and the metallurgy was enhanced. A reciprocating file was introduced in 2008 by Yared, which lead to the single file concept, and both continuous rotation and reciprocating motions are now used.<sup>8</sup>

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## ACRONYMS

<b>GP:</b>	Gutta Percha
<b>NiTi:</b>	Nickel Titanium
<b>OS group:</b>	Fixed Taper
<b>VC:</b>	3-D volume of the canal
<b>VO:</b>	3-D volume of obturation
<b>WO group:</b>	Variable Taper

NiTi rotary files have either fixed or variable tapering. Fixed tapered files have a constant angle of increasing diameter along the active portion of the file, while variable-tapered files have different tapers of increasing and decreasing angles along that portion of the file. Variable-tapered files have been shown to result in greater straightening and transporting of the outer aspect of the apical curvature when compared with the effect of the fixed-tapered file. On the mid-root curvature, the variable-tapered file was better in preserving tooth structure than were fixed-tapered endodontic files.<sup>9-11</sup>

Root canal obturation refers to forming a fluid-tight seal to completely fill the root canal system with non-irritating material from the apical foramen to the orifice level, preventing the apical, lateral and coronal microleakage that is known to affect the long-term success of endodontic treatment.<sup>12</sup> It has been shown that both the quality of both the obturating material and of the coronal restoration relate significantly to the status of the periodontium, determining root canal success or failure.<sup>13-15</sup>

While many obturation materials have been introduced, Gutta Percha (GP) remains the most widely used. A number of techniques to facilitate GP placement and to improve the quality of obturation have been developed; recent examples are Thermanfill and GuttaCore (Dentsply/Sirona, Germany). Studies have shown that obturating systems frequently present with voids, which become colonized by bacteria and are therefore associated with microleakage.<sup>16</sup> Therefore, the quality of the obturation seal is of paramount importance.

Another factor affecting the quality of obturation is the position of the termination of the root canal filling. The most desirable length has not been exactly determined<sup>12</sup> and is controversial, but it is accepted that extrusion of the filling material is associated with failure<sup>17</sup> and a reduction in healing rate.<sup>18</sup> Histologically, the minor apical constriction located 0.5mm from the external surface determines the apical limit of the root canal and thus both instrumentation and obturation should be limited to this area.<sup>19</sup>

Previous studies have shown the effect of file taper on the preparation of the root canal system<sup>9-11</sup> and the effect of the taper on the extrusion of obturating materials beyond the apical foramen.<sup>20</sup> No studies have been found relating the effect of the geometry of the taper (fixed versus variable) to the quality of obturation in terms of the presence of voids, or the amount of extrusion of GP. Therefore this *in vitro* study set out to evaluate these variables; the null hypothesis was that there would be no difference in the quality of root canal obturation when canals are prepared with either fixed or variable tapers.

## MATERIAL AND METHODS

Ethical approval for the use of extracted teeth was granted by the University Human Research Ethics Committee (W-CJ-160615-1). Permanent sound single-rooted anterior and premolar teeth having roots with a curvature less than 25° were included. C-shaped or oval canals and teeth with canal diameters greater than size 25 GuttaCore size verifier were excluded. To detect an effect size of  $d = 0.75\mu\text{m}^3$ , at 80% power and at a 5% significance level, a sample size of 29 teeth per group was required.<sup>21</sup> To allow for any errors in method, 32 teeth per group were used.

After selection, each tooth was cleaned from any attached bone or tissue using a number 15 scalpel and high speed handpiece with a long diamond bur (Mani, Inc, Japan). Thereafter all the teeth were stored in formalin (pH 7.25) at room temperature for approximately two months. Before preparation, each tooth was mounted in an acrylic resin block of size 3x2x3cm (Sure Acrylic, packaged for Confi-Dent Agencies, SA) to facilitate handling.

The selected teeth were randomly divided into two groups: OS group: 32 teeth were prepared with a fixed taper (One Shape file, MicroMega, France) and the WO group: 32 teeth were prepared with a variable taper (Wave One Gold primary file, Dentsply/Sirona, Switzerland). The samples were standardized by grinding the occlusal table to create a length of 15mm for all teeth. All the procedures (preparation and obturation) were performed by a single operator at room temperature using a dental operating microscope (Carl Zeiss Surgical GmbH, Germany) at 5.1 x magnification .

Patency was established and a glide path was prepared for each tooth using sizes 8 and 10 K files (MicroMega, France) as required. One G (MicroMega, France) and Proglider (Dentsply/Sirona, Switzerland) files were used for rotary glide path preparation for OS and WO groups respectively, following the manufacturers' instructions for speed and torque. The working length was established once a size 10 K file (MicroMega, France) appeared through the apical foramen. It was withdrawn by 0.5mm to establish the working length.

The canals were then prepared using the One Shape file for the OS group and the Wave One Gold primary file for the WO group. The mechanical preparations were performed as per the manufacturers' instructions, including single file use. All teeth prepared with Wave One Gold files were completed with the primary file only. An X Smart plus motor (Dentsply Sirona, Switzerland) was used in both

rotary glide path preparation and mechanical preparation for both the Wave One gold and One Shape file systems. Figure 1 shows the 3-D volume of typical preparations of the canals.



**Figure 1.** A 3-D volume of typical preparations of the canals, with the fixed tapered preparation on the left, and the variable tapered preparation on the right.

The irrigation solutions were standardized for both groups as follows: irrigation during instrumentation was done with 5ml of 6% NaOCl with a 29 gauge/17mm NaviTip needle (Ultradent, USA); the final rinse protocol was done using 2ml of 6% NaOCl solution for three minutes followed by 1ml 17% EDTA solution for one minute. While the 6% NaOCl filled the canal, it was manually agitated 50 to 60 times using a GP master apical cone.

Before obturation, each canal was thoroughly dried using paper points (Dentsply/Sirona, Switzerland). The GuttaCore obturator system was used according to the manufacturer's instructions. A GuttaCore size 25 verifier was used to confirm the apical fitting. The sealer (AH Plus sealer, Dentsply/Sirona, Switzerland) was wiped on the canal wall to the full working length, using a size 25 paper point. Sealer excess was removed with a smaller paper point.

The GuttaCore obturator was heated in a Thermaprep 2 oven (Dentsply/Sirona, Switzerland) and then slowly inserted in a gentle continuous motion (for 6 to 7 seconds) to the determined working length. Two minutes after obturation the handle of the GuttaCore obturator was removed by bending the handle to the side several times until it was severed.

After obturation, the teeth were stored in a digital incubator (IncoTherm, Labotec, South Africa) at 37°C and 100% humidity for five days to facilitate complete setting of the sealer prior to microCT ( $\mu\text{CT}$ ) scanning (Nikon Metrology XTH 225/320 LC Micro-CT scanner, Germany).



A software programme (Avizo 7.0, VGStudio MAX 3.0) was manipulated to establish a straight vertical axis of the tooth and to distinguish the images of tooth structure from the obturation and voids. Only the apical 12 mm of each tooth was included for analysis, while the rest of the coronal part of the tooth image was removed.

The 3-D volume of the canal (VC) and the volume of obturation (VO) were measured in  $\mu\text{m}^3$  and then the 3-D difference (D) was calculated by deducting the VO from the VC. The percentage difference (D%) was calculated using the following equation:  $VC - VO/VC * 100$ . The volume of any extruded GP (without sealer) beyond the apical foramen, was measured in  $\mu\text{m}^3$ . Fig. 2 shows a sagittal view of the extruded GP, and Fig. 3 shows a 3-D view.



Figure 2. Sagittal view of extruded GP without sealer.

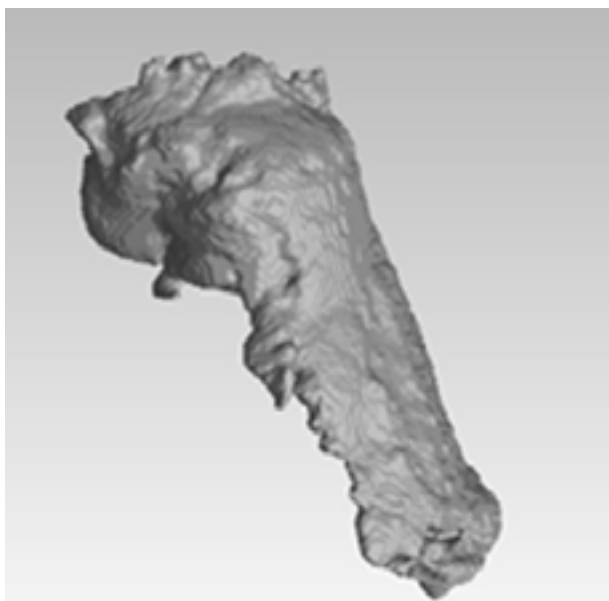


Figure 3. Three-dimensional view of extruded GP.

Data analysis was performed using SAS 9.4 for Windows (SAS Institute Inc; Cary, North Carolina, United States of America). The Wilcoxon rank sum test was applied to assess the relationship between each outcome and the OS and WO groups (the data did not meet the assumptions of an independent samples t-test). The strength of any associations was measured by *r*, using the following scale:  $\geq 0.80$  (large effect), 0.50 to 0.79 (moderate effect), 0.20 to 0.49 (small effect) and  $\leq 0.20$  (near zero effect).

RESULTS

The univariate statistics for all the variables are shown in Table 1. All variables showed statistically significant differences between the two groups, although the effect sizes were small (Table 2).

**Table 2.** Statistically significant differences and effect sizes.

Variable	p-value for between-group test	Effect size (r)
D	0.0034	0.38
D%	0.0041	0.38
E	0.0013	0.42

No obturated canal obtained a 100% seal and it is therefore concluded that all must have contained voids. The WO group resulted in a greater volume of obturated GP (represented by the difference in volume, D, and the percentage differences, D%) and a significantly smaller amount of extruded GP (Fig. 4). However, the effect sizes of all the differences were small.

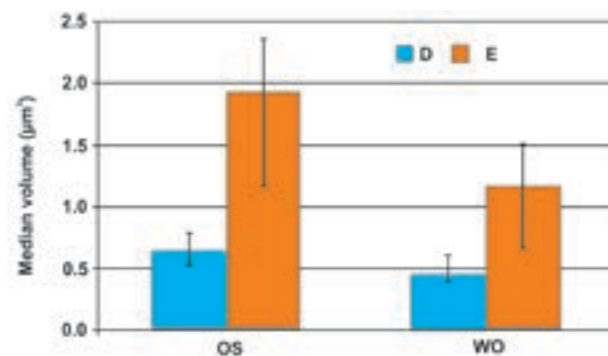


Figure 4. The median volume difference (D) and volume of extruded obturation (E). The error bars denote the inter-quartile range.

The strength of association between the tapered angle of the root canal and the volume of extruded GP was tested. The analysis of the result showed that the correlation was small ( $r = 0.42$ ).

**Table 1.** Univariate statistics. SD: standard deviation; OS: OneShape group; WO: WaveOne group; D: difference in volume between canal preparation and obturation ( $\mu\text{m}^3$ ); D%: percentage difference in volume between canal preparation and obturation; E: volume of extruded material ( $\mu\text{m}^3$ ).

Group	Variable	Mean	SD	Median	Inter-quartile range	Range (min-max)
OS (n=32)	D ( $\mu\text{m}^3$ )	0.68	0.22	0.65	0.52-0.79	0.26-1.28
	D%	10.6	2.2	10.6	9.5-12.4	5.1-13.8
	E ( $\mu\text{m}^3$ )	1.94	0.97	1.92	1.16-2.36	0.42-4.02
WO (n=32)	D ( $\mu\text{m}^3$ )	0.54	0.22	0.45	0.39-0.61	0.32-1.19
	D%	9.2	3.6	8.5	6.4-10.7	5.7-24.2
	E ( $\mu\text{m}^3$ )	1.16	0.68	1.16	0.66-1.51	0.00-2.99

## DISCUSSION

Clinically, voids in root fillings are difficult to detect because conventional x-rays give a limited two-dimensional view of the tooth.<sup>22</sup> Root canal obturation from a conventional radiograph is regarded as acceptable when the density is uniform along the canal from the orifice level to the terminus and compatible with the canal walls.<sup>23</sup>

*In vitro*, many methods (dye penetration, fluid transport, etc.) have been used to investigate the sealing ability of root filling techniques and materials.<sup>24,25</sup> However, all had the limitation of measuring voids by analysis of sectioned roots and digital imaging software. Those approaches may not be accurate enough because some filling material might be lost in the process.<sup>25</sup>

However, because of the inaccuracy and lack of standardisation of the previous methods, researchers have moved to a non-destructive, reproducible and more accurate method of evaluating the quality of root filling materials using  $\mu$ CT. The value of the use of  $\mu$ CT has been demonstrated in previous studies.<sup>26,27</sup> It is non-destructive, non-invasive and gives a 3-D visualisation of the defect and continuity of the defect in the root filling material.

This study analysed the volume of obturation of root canals as an indication of the effectiveness of canal preparation with two different canal preparation geometries, namely fixed taper (obtained using the OneShape system) and variable tapered preparations (using the WaveOne system).

The results showed that voids were present within the obturation as there were no canals that had a 100% seal. This is in accord with other studies.<sup>28,29</sup> The variable tapered canals had a significantly better volume of obturation and significantly less extrusion of material. However, the effect sizes were small. An earlier study by Allison et al (1979)<sup>5</sup> showed a strong correlation between canal taper and the quality of obturation: a flared (tapered) preparation had better obturation than did the standardized technique. However, those authors used cold lateral condensation rather than the flowable obturation technique used in this study, which is not dependent on any condensing instrument.

A study comparing three different tapered preparations (4%, 6% and 8%) on the quality of thermoplastic obturation found that the larger the taper the better the obturation. There was no significant difference between 6% taper and 8% taper but both were significantly better than the 4% taper,<sup>30</sup> implying improvements in obturation with increasing taper. The current study, however, kept the taper relatively constant, but varied the shape geometry, so that when the apical taper is large enough, greater than 6%, the geometrical shapes of fixed and variable tapers have a small impact on the quality of the obturation.

A possible explanation for the statistically significant difference between the OS and WO groups could be related to the volume of the canals created by each file system. Shaping canals with the One Shape file resulted in a larger volume of the prepared root canal ( $230.057\mu\text{m}^3$ ) when compared with the WO group in which the total volume of the prepared canal was  $187.1\mu\text{m}^3$ .

With respect to the extrusion of GP beyond the apical foramen, this is a common finding in endodontics.<sup>31</sup> The incidence of extrusion of thermoplasticized GP has been shown to be 50% compared with 20% for cold lateral obturation,<sup>32</sup> and Thermafil obturation had more extruded GP than other obturation techniques.<sup>33,34</sup> Although flowable GP (chemical or heated GP) is shown to have a better quality of obturation than cold obturation,<sup>35,36</sup> a meta-analysis indicated that it was associated with more extrusion.<sup>37</sup>

In the current study, the fixed taper resulted in a higher volume of extruded GP than in the variable taper preparation. Extrusion of GP was detected in all the specimens except one. These findings support the statement by Buchanan (2000)<sup>6</sup> that variably tapered preparations resulted in a smaller apical diameter thus reducing the extruded GP. On the other hand, it has been shown that extrusion can also relate to the filling material, when it was found that Thermafil plus but not Realseal was affected by preparation taper and resulted in significantly higher extrusion.<sup>38</sup>

It has also been shown that the insertion rate affects the overfill or underfill of the obturation. An insertion rate of thermoplastic GP that produced fewer voids also produced undesirable extrusion.<sup>39</sup> In the current study, only the GuttaCore obturation system was used, so it is possible that the extrusion may have been due to the rate of insertion.

A possible limitation of the study was that only one obturation material was used, and one sealant, and a single obturation technique, but this was to standardise the obturation as a fixed effect.

Although irrigation plays an integral role in reaching inaccessible areas for instrumentation, disintegrating soft tissue, removing the smear layer and disinfecting the canal,<sup>40,41</sup> it has been shown that the root canal system should be prepared up to size 30 at least for irrigation to reach the apical third.<sup>2</sup> However, enlargement of the root canal system during shaping procedures can increase the risk of root fracture. For example, root fracture is a common finding in maxillary premolars because of the small mesiodistal dimension of their roots.<sup>42</sup>

Furthermore, cracks in radicular dentine have been found to be associated with endodontic retreatment irrespective of whether rotary or hand file instruments were used.<sup>43</sup> Caution should therefore always be exercised to avoid the undue enlargement of root canals.

## CONCLUSIONS

Both systems studied, Wave One Gold and One Shape files, could be used to prepare root canals adequately for obturation. This study has shown that when the apical taper is large enough, 6% - 8%, the geometrical shapes of fixed and variable tapers have a small impact on the quality of the obturation. The variable tapered preparation showed slightly less GP extrusion than did the fixed tapered preparation. The value of  $\mu$ CT as an accurate research tool in Endodontics has been re-emphasized.

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# Oral health status among Nyaope users at drug rehabilitation clinics in Johannesburg

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## ABSTRACT

Nyaope is an extremely addictive drug mixture having devastating health effects. This comparative cross-sectional analytical study was conducted at two drug rehabilitation clinics in Johannesburg.

**Method:** A total of 51 nyaope users and 25 matched non-drug users (NDUs) were recruited. To compare the oral health status between the groups, the DMFT (decayed, filled and missing), PUFA, (pulpal involvement, ulceration caused by dislocated tooth fragments, fistula and abscess), BOP (bleeding on probing) and PPD (periodontal pocket depth) scores were measured. Additionally, a validated questionnaire was administered to assess sociodemographic, diet and dental behaviour among the participants.

**Results:** The mean age of nyaope users was 26.4±4.84 years and of NDUs, 26.04±4.09 years. The prevalence and severity (mean DMFT) of dental caries was significantly higher in Nyaope users than NDUs (82.35% vs. 48.0%;  $p=0.03$ ) and [3.97±4.11 vs. 2.04±2.81 ( $p=0.03$ )] respectively. There was no significant difference in the prevalence of BOP ( $p=0.50$ ) and PPD ( $\geq 4$ mm) ( $p=0.53$ ) between two groups and the PUFA scores were similar. Only 51% of nyaope users (vs. 100% NDUs) reported daily brushing and 100% (vs. 56% of NDUs) had a highly cariogenic diet.

**Conclusion** Nyaope users had significantly higher cariogenic diets, caries prevalence, and DMFT scores compared with NDUs.

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## ACRONYMS

<b>BOP:</b>	Bleeding On Probing
<b>CPITN:</b>	Community Periodontal Index and Treatment Need
<b>DMFT:</b>	Decayed, Missing, Filled Teeth
<b>IV:</b>	Intravenously
<b>NDUs:</b>	Non-drug users
<b>PPD:</b>	Periodontal Pocket Depth
<b>PUFA:</b>	Pulpal Involvement, Ulceration Caused by Dislocated Tooth Fragments, Fistula and Abscess
<b>SACENDU:</b>	South African Community Epidemiology Network on Drug Use
<b>WHO:</b>	World Health Organisation

## INTRODUCTION

Drug use is an alarmingly common problem in South Africa (SA) and globally and is associated with significant mortality and morbidity.<sup>1-4</sup> Illicit drug users in Africa comprise about 17% to 21% of the total illicit drug users worldwide.<sup>5</sup> In Gauteng, 4026 admissions to 18 treatment centres were recorded from January to June 2013. The most commonly used substance was cannabis (40%), followed by alcohol (27%), heroin (12%), methcathinone (8%), 'nyaope' (4%), methamphetamine (3%) and cocaine (3%).<sup>6</sup> 'Nyaope' is a drug cocktail consisting of varying mixtures of heroin, marijuana, anti-retroviral drugs, rat poison etc., which has become a popular trend among South African youths.<sup>7</sup> Nyaope, also known as 'whoonga' and 'sugars', is a lethal and extremely addictive South African street drug which continues to ravage the lives of youth and shatter communities.<sup>8,9</sup>

Nyaope is reported to have originated in the townships of Soshanguve and Mamelodi in Pretoria in 2000. Since then many people, almost all of whom are poor and black have become addicted to the drug which is very accessible due to its low cost (approx. R30 a joint).<sup>10,11</sup> In 2013, the average age of nyaope users was 24 and even primary school children reportedly used the drug.<sup>6,11</sup>

Nyaope use has a significant impact on health, society and the economy.<sup>11,12</sup> Nyaope use has adverse effects on multiple systems of the body including the oral cavity. Nyaope users experience great psychological and physical turmoil when trying to stop using the drug. There is inadequate infrastructure for the rehabilitation of nyaope

users in the public sector and they are too poor to afford private rehabilitation centres. Additionally, nyaope users require a minimum of one year of comprehensive care for successful rehabilitation.<sup>11</sup>

Although the destructive effects of nyaope have been widely publicized in the media, very few South African studies have objectively examined the systemic effects of nyaope. There are no studies which have examined the oral health of nyaope users. It is important to examine the oral effects of each of the potential constituents of nyaope, as well as the oral effects of other commonly used drugs because it contains a variety of drugs (ranging from cannabis, heroin and methamphetamine) and users commonly practice poly-drug abuse.<sup>12</sup>

Heroin use is associated with increased incidence of dental caries, xerostomia, periodontal disease, oral fungal and viral infections and hyperpigmentation of the tongue.<sup>13,14</sup> Dental caries in heroin users are darker and are typically located on the buccal and labial surfaces, features that may be pathognomonic for heroin use.<sup>2</sup>

Cannabis use causes xerostomia and, therefore, chronic use is associated with a higher risk of caries. Cannabis, when smoked or chewed, also may cause 'cannabis stomatitis.' This is a condition characterized by hyperkeratosis and leukoedema of the buccal mucosa which, with chronic use, may progress to leukoplakia and neoplasia of the oral epithelium.<sup>15</sup> Additional effects of cannabis use include gingivitis, alveolar bone loss, gingival hyperplasia, oral papillomas, uvulitis and tongue carcinoma.<sup>13</sup>

The chronic use of methamphetamine results in a condition called 'meth mouth' which is characterized by severe dental caries located specifically on buccal and lingual surfaces together with extensive destruction of coronal tooth structure.<sup>16</sup> Methamphetamine is a sympathomimetic amine that causes vasoconstriction of the vasculature of salivary glands leading to reduced salivary flow.<sup>17</sup> Methamphetamine is more likely to result in the loss of teeth when used intravenously as opposed to smoking the drug.<sup>18</sup>

The present study was conducted at two drug rehabilitation centres in Johannesburg in order to characterise the effects of nyaope on oral health and to investigate the oral health behaviours of nyaope users.

The aim of the study was to determine the oral health status (i.e. periodontal status, soft and hard tissue status) of nyaope users and to examine risk factors associated with oral diseases at two drug rehabilitation clinics in Johannesburg. The objectives of the study were to determine the demographic characteristics of nyaope users and to compare the oral health status scores of nyaope users at two drug rehabilitation clinics in Johannesburg against those of a matched group of non-drug users, using epidemiological tools such as the decayed missing filled teeth (DMFT) and pulpal involvement, ulceration caused by dislocated tooth fragments, fistula and abscess (PUFA). Additionally, this study sought to compare oral health behaviours and oral hygiene practices among nyaope users and non-drug users in this cohort of patients.

## METHODS

### Study design

This was a comparative cross-sectional analytical study which included patients (i.e. nyaope users) from Empilweni drug rehabilitation centre (Soweto) and Nishtara Alcohol and Drug Centre (Lenasia) in Johannesburg. Matched patients were non-drug users (NDUs) recruited from a community dentistry outreach site in Johannesburg, the OR Tambo clinic. This primary care clinic serves the community of Diepsloot, Johannesburg, and provides basic medical and dental services. Patients who attended for routine medical check-ups were recruited as matched NDUs. Patients attending the dental services section of the clinic were excluded.

### Patient selection

Patients who were admitted to these two-drug rehabilitation centres from 1 September 2016 to 29 December 2016, were invited to participate in this survey. Nyaope users were identified with the aid of in-patient records. The control group of NDUs were patients with social demographics (i.e. age, gender and race) matching those of patients in the nyaope group. All nyaope users and NDUs provided written informed consent. Nyaope users were alert and not intoxicated when informed consent was obtained. All the participants were 18 years old or above.

### Sample size

Sixty-one patients were admitted to the Empilweni Drug Rehabilitation Centre and Nishtara Drug Centres from 1/09/16 to 29/12/16. Ten nyaope users refused hospital admission (i.e. signed refusal of hospital treatment form), and were not included in the study. Fifty-one nyaope users were interviewed and examined from 1/09/16 to 29/12/16. For maximum conformity of data and verification of this study method, 25 matched NDUs were recruited. There was one NDU for every two nyaope users (1:2 ratio). This recruitment was similar to a study by Mateos-Moreno et al which compared the oral health of 70 drug addicts with that of a control group comprising 34 patients.<sup>19</sup> All 25 NDUs who were examined were male as virtually all nyaope users were male (i.e. 50 out of 51).

### Data collection

Data collection for the study involved the completion of a questionnaire by participants. The questionnaire was derived from the World Health Organization Alcohol, Smoking and Substance Involvement Screening Test version 3.0 (WHO ASSIST V3.0) questionnaire and the American Dental Association proposed health questionnaire.<sup>20,21</sup> It was modified to meet the aims and objectives of the study. As nyaope was not listed in the WHO ASSIST V3.0 questionnaire, it was added under the drug history section of the questionnaire in this study.

The World Health Organization (2013) oral health assessment form was utilized in the determination of the oral health of all the study participants.<sup>22</sup> The form provided for the recording of the clinical findings which included periodontal status and decayed, missing, filled teeth (DMFT) score, and, additionally, the recording of

the pulpal involvement, ulceration caused by dislocated tooth fragments, fistula and abscess (PUFA) scores for the clinical consequences of untreated caries in both groups. The bleeding on probing (BOP) and periodontal pockets depth (PPD) were graded with the use of the modified community periodontal index (CPI) which entailed examination of pocket depths and gingiva for bleeding.

The PUFA score was calculated as the sum of each component score. Untreated caries PUFA ratio was calculated by following method:<sup>23</sup>

$PUFA \times 100/D$  (D= Decayed component of DMFT score)

A score for gingival BOP and PPD was given based on the presence or absence of condition.<sup>22</sup>

Gingival bleeding on probing score (BOP)	Periodontal pocket depth score (PPD)
0 = Absence of BOP	0 = Absence of PPD
1 = Presence of condition	1 = Pocket 4-5 millimeter (mm) 2 = Pocket 6 mm or more
9 = Tooth excluded	9 = tooth excluded
X = Tooth not present	X = Tooth not present

### Data analysis

The collected data was analysed using Statistica version 13.2. Descriptive and inferential statistical analysis were performed at  $p < 0.05$ . For comparisons involving contingency cells with very small numbers ( $<5$ ), the Fisher Exact Test was used.

### Ethics

This research received ethics approval from the Human Research Ethics Committee of the University of the Witwatersrand (Ethics Clearance no : M160610). Further permission and consent were sought from the Empilweni Drug Rehabilitation Centre and Nishtara Alcohol and Drug Centre, as well as from each of the participants.

## RESULTS

### Demographics of nyaope users and NDUs:

Baseline characteristics of nyaope users and NDUs are shown in Table 1.

Demographics	Nyaope users (n = 51)	Matched NDUs (n = 25)	p-value
Age (mean±SD)	26.40 ± 4.84	26.04 ± 4.09	0.75
Gender (%)			
Male	50 (98.04)	25(100)	0.95
Female	1 (1.96)	0	0.67
Race (%)			
Black	48 (94.12)	25 (100)	0.86
Coloured	3 (5.88)	0	0.31
Education (%)			
Primary school	34 (66.67)	3 (12.00)	0.004
High school	15 (29.41)	14 (56.00)	0.144
College	2 (3.92)	8 (32.00)	0.004

### Diet and brushing habits of nyaope users and NDUs:

Persons who consumed junk food (i.e. soft drinks and sugary foods) on a daily basis were categorized as having an unhealthy diet. The number of nyaope users brushing their teeth twice daily was also significantly lower than the non-drug users ( $p$ -value 0.0003). Twenty-five nyaope users reported that they never brushed their teeth or did so only occasionally. Table 2 illustrates the diet and brushing habits of nyaope users and NDUs.

	Nyaope users (n = 51)	Matched NDUs (n = 25)	p-value
Diet (%)			
Healthy diet	0	11 (44)	<0.001
Unhealthy diet	51 (100)	14 (56)	0.004
Brushing habits (%)			
Never	4 (7.84)	0	0.0002
Occasionally	21 (41.18)	0	0.002
Once daily	22 (43.14)	10 (40)	0.86
Twice daily	4 (7.84)	15 (60)	0.0003

### Comparison of oral health of nyaope users and NDUs:

There was a significantly higher mean DMFT score amongst the nyaope users when compared with the NDUs ( $p = 0.03$ ). Tables 3 and 4 illustrate mean DMFT and PUFA scores and the prevalence of each component of the DMFT index, the BOP and PPD scores among nyaope users and NDUs, respectively.

Indices	Nyaope users (Mean±SD)	Matched NDUs (Mean±SD)	p-value
DMFT score	3.97 ± 4.11	2.04 ± 2.81	0.03
Decayed	2.92 ± 3.23	1.56 ± 2.16	0.03
Missing	0.86 ± 1.50	0.36 ± 0.86	0.12
Filled	0.19 ± 0.80	0.12 ± 0.43	0.65
PUFA index	1.19 ± 3.05	0.68 ± 1.28	0.42
Pulpal	1.15 ± 3.06	0.68 ± 1.28	0.45
Ulceration	0.04 ± 0.28	0	0.48

Please note there were no fistula and abscess formation in both groups.

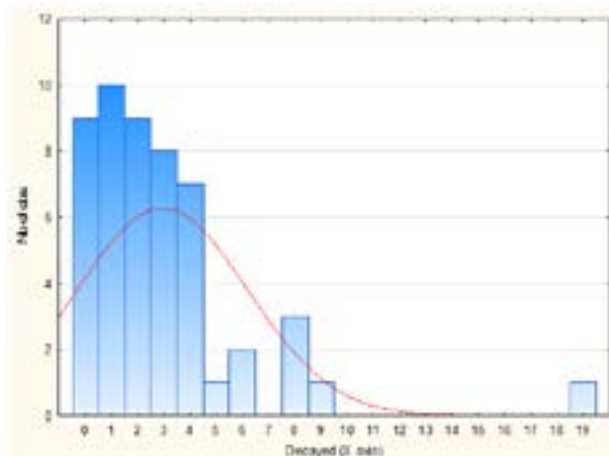
Variables	Nyaope users %	Non-drug users %	p value
Decayed	82.35	48	0.03
Missing	39.22	24	0.34
Filled	7.84	8	0.98
BOP	19.61	16	0.50
PPD (≥4mm)	13.73	16	0.53

The untreated caries PUFA ratios among nyaope users and NDUs were similar (40.94% and 43.59%), indicating that these proportions of the decayed component had progressed to pulpal involvement.

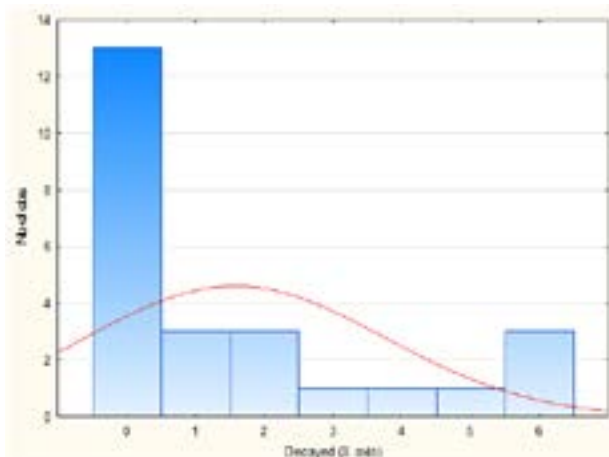
Figure 1 shows the frequency histogram depicting non-normal distribution of decayed teeth among nyaope



addicts with a median of 2.0 (interquartile range 1.0-4.0). This histogram shows that nine nyaope addicts had a decayed score of 0. The highest number of nyaope addicts ( $n=10$ ) had decayed scores of 1. Only four nyaope addicts had a decayed score of 8 and 9. One nyaope addict had the highest decayed score of 19.



**Figure 1.** Frequency histogram depicting non-normal distribution of decayed teeth among nyaope users (X axis: number of decayed teeth. Y axis: number of cases with decayed teeth).



**Figure 2.** Frequency histogram depicting non-normal distribution of decayed teeth among non-drug users (X axis: number of decayed teeth. Y axis: number of cases with decayed teeth).

## DISCUSSION

This research aimed to characterize the oral health status and behaviour of nyaope users. All those in the current study were male except for one female, a finding which is similar to that described by other studies.<sup>6,11</sup>

Blacks (94.12%) were the predominant users of nyaope in this study followed by Coloureds (5.88%). The socio-economic characteristics (age, race and gender) of the nyaope users in our study are similar to those featured in a report on the characteristics of drug-related admissions in all South African provinces from January to June 2013 by South African Community Epidemiology Network on Drug Use (SACENDU).<sup>6</sup> The mean age of nyaope users in this study was 26.4 years, whilst SACENDU reported a mean age amongst Gauteng users of 24 years.<sup>6</sup>

The predominant method of using nyaope in this study was through smoking (84.31%). However, a small number used the drug through the IV route (5.89%) or

through a combination of smoking and IV route (9.80%). These findings were also consistent with the SACENDU survey.<sup>6</sup>

The study showed nyaope users to have a diet consisting mostly of processed foods (e.g. biscuits, chips) and sugary drinks, significantly more unhealthy than that of NDUs (100% vs 56%;  $p=0.004$ ). Whilst the literature on the dietary habits of nyaope users is scarce, there is evidence indicating that drug addicts have a poor diet which is often rich in sugar.<sup>2</sup> The findings of the current study were similar to those of Schulz-Katterbach et al. and Robinson et al.<sup>14,24</sup>

Schulz-Katterbach et al. examined the risk of caries among 43 marijuana users (cases) and 42 cigarette smokers (controls).<sup>24</sup> The study found that marijuana users had a considerably higher consumption of sugary drinks than did cigarette smokers ( $p=0.0078$ ).<sup>24</sup> In another study, Robinson et al. examined the oral health behaviour of British drug abusers, most of whom used heroin.

Their report highlighted the conclusion that although drug use was associated with appetite suppression among drug users, it also caused them to crave sugar-rich foods (e.g. doughnuts, sugary drinks).<sup>14</sup> Thus, it appears that abusers of marijuana and heroin, which are the main constituents of nyaope, have a propensity to consume sugary foods and drinks.<sup>14,24</sup>

There are no studies regarding the brushing habits and oral health of nyaope users. In this investigation, nyaope users were less likely to brush their teeth when compared with NDUs ( $p=0.002$ ). A matched case-control study examined the oral diet, oral health behaviour and caries status among cases (methamphetamine abusers,  $n=18$ ) and controls (non-methamphetamine users,  $n=18$ ).<sup>25</sup> The likelihood of methamphetamine users never brushing their teeth was significantly higher in comparison with that of controls ( $p<0.001$ ),<sup>25</sup> a finding similar to that of the current study.

The mean DMFT score was significantly higher ( $p=0.03$ ) among nyaope users in comparison with NDUs. Nyaope users also had significantly higher prevalences of dental caries compared with NDUs ( $p=0.03$ ). These observations were similar to those of a study which was conducted by Smit on 308 methamphetamine users.<sup>26</sup> Possible reasons for the higher DMFT score among nyaope users were the poor diet and poor oral hygiene, chronic use of nyaope and poly-drug use and unfavourable socioeconomic circumstances (poor education and unemployment). All of the NDUs brushed their teeth at least once daily whereas only 51% of the nyaope users did so. Also, Mateos-Moreno found that the mean DMFT score was significantly higher among poly-drug users than control subjects ( $p<0.001$ ).<sup>19</sup>

Although the mean DMFT score of nyaope users in the present study was higher than amongst the matched NDUs, it was significantly lower than the DMFT scores of drug users reported by multiple previous studies.<sup>19,27</sup> Possible reasons for this finding in this investigation were comparatively better oral hygiene among nyaope users (51% brushed teeth daily), shorter duration of nyaope use ( $6.8\pm 3.42$  years) and younger age ( $26.4\pm 4.84$ ). A Chinese study which studied the oral health of ex-heroin users

(n=445) also demonstrated mean decayed, filled and missing teeth indices similar to those of the present study. Seventy five percent of the Chinese subjects brushed their teeth daily.<sup>28</sup> Notably, drug users in this present study and the Chinese study had better oral hygiene practices than did those of the 64 drug users reported by Mateos-Moreno et al. (only 36% brushed teeth daily).<sup>19,28</sup> That comprehensive survey examined the oral health of poly-drug users who had been using drugs for a period of up to 30 years, substantially more than the nyaope users in the present study (maximum of 15 years). It is possible that the longer duration of drug use amongst the subjects in the study by Mateos-Moreno contributed to their higher DMFT score.<sup>19</sup>

The mean PUFA score among nyaope users and NDUs was 1.19 and 0.68 respectively. As there is a paucity of literature on the PUFA indices of poly-drug users, these findings could not be compared. The clinical consequences of untreated caries may be objectively measured by the 'Untreated Caries, PUFA Ratio',<sup>23</sup> which in this study among nyaope users and NDUs was 40.9% and 43.6%, respectively. This indicated that 40.9% of nyaope users and 43.6% of NDUs had progression from dental caries to pulpal involvement. These findings indicate that a significant proportion of these individuals do not seek care in the early stages of the diseases and possible wait for the appearances of clinical signs and symptoms of tooth decay before seeking help. These factors highlight the need for prompt treatment of dental caries (i.e. endodontic treatment and extraction).

Bleeding on probing was higher among nyaope users (19.61%) than NDUs (16%), although the difference was not significant ( $p=0.50$ ). Reddy et al. conducted a comparative study which examined the periodontal status of drug users (n=250) and age- and sex- matched non-drug users (n=250). Drug users were found to have a lower BOP than the control group ( $p<0.001$ ), a lower prevalence which may be explained by the high rate of smoking (67.6%) among the drug users.<sup>29</sup> Equally, the low prevalence of BOP in the present study may also be associated with the high prevalence of smoking among both groups (i.e. all nyaope users and about half of non-drug users).

Smoking reduces BOP through vasoconstriction of the gingival blood vessels and limiting blood flow to the gingivae. Smoking results in blunting of the normal inflammatory cascade that is activated when gingivae are exposed to bacterial plaque. Therefore, the actual extent of gingival inflammation may not be clinically visible.<sup>29</sup>

The current study found periodontal pocket depth scores (i.e. pockets  $\geq 4$ mm) present among 13.73% of nyaope users. Ma et al. reported on a sample of 445 ex-heroin abusers, 197 of whom were younger than 35 years. Among the younger users, 17.3% had periodontal pockets. All the nyaope users in the present study except for one were of ages  $\leq 35$  years. Therefore, the prevalence of periodontal pockets among nyaope users in this study was similar to that of ex-heroin users in the study by Ma et al.<sup>28</sup> Possible reasons for the lower prevalence in periodontal diseases (i.e. BOP and PPD scores) in the present study were a reduced number of study participants (n=76), younger study participants (mean age 26 years) and shorter duration of nyaope use (1-15 years).

The sample size of this study was comparatively smaller than those of the studies described previously.<sup>28,29</sup> Study of the literature has indicated that periodontal diseases have a strong association with increasing age and duration of drug use.<sup>28</sup>

### Limitations of study

This study has a number of limitations. Importantly, there has been no previous research on the oral health behaviour of nyaope users and the effects on oral health of nyaope use. Therefore, the results of this study could not be compared with previous studies. The sample size of the study was relatively small due to resource constraints. These included limited availability of assistants for data collection and a low admission rate of nyaope users at the rehabilitation centres. Education was a significant confounding factor in this study as it may have resulted in a lower mean DMFT score among control groups. It is likely that a large number of nyaope users do not seek help and do not admit themselves to rehabilitation facilities. Therefore, a significant number of nyaope users with poor oral health are missed.

### CONCLUSION

Nyaope users had significantly higher cariogenic diets, caries prevalence, and DMFT scores compared with non-drug users. Additionally, Nyaope users were also significantly less likely to practice daily brushing than non-drug users. Risk factors associated with sub-optimal oral health were inadequate education, poor diet and oral hygiene practices, unemployment and prolonged nyaope use.

### Recommendations

A number of steps can be taken to improve the oral and general health of nyaope users in the community. Large scale studies are required to confirm the findings of this study and also to provide further knowledge in the behaviour (including oral health behaviour) and the oral health of nyaope users. Adequate oral health among nyaope users can only be achieved through a holistic approach. The management of nyaope addiction should address the physical (including oral health), psychological, socio-environmental and political aspects of the disease. Every nyaope addict admitted to a rehabilitation centre must have a complete and thorough initial physical examination and must be referred to a physician, a psychologist and a dentist. They must be counselled at each opportunity and by each health professional about the harmful effects of nyaope.

However, these measures may not suffice. The reality is that successful rehabilitation of hard-drug addicts is a very complex problem and requires the participation of families, communities and politicians. Family members have an important role in the rehabilitation of nyaope users.

It is important to note that a number of recommendations applicable to poly-drug users appear to also apply to nyaope users. Drug use in general appears to have serious adverse oral health effects which warrants that this group be regarded as high risk for oral diseases.

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## Do the CPD questionnaire on page 44



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- Select the CPD navigation tab.
- Select the questionnaire that you wish to complete.
- Enter your multiple choice answers. Please note that you have two attempts to obtain at least 70%.
- View and print your CPD certificate.



# A comparative analysis of traditional dental screening versus teledentistry screening

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## ABSTRACT

This comparative analysis determined the reliability of using intraoral cameras and communication technologies (ICTs) to screen primary school children for dental caries.

## Methods

A concordance study assessed the diagnostic agreement between traditional and teledentistry screening of dental caries in 233 school children aged 6-8 years old from randomly selected rural primary schools. Clinical screening, scored for DMFT, was carried out by two trained and calibrated examiners.

Two trained and calibrated teledentistry assistants (TAs) captured intraoral images, and stored the data in corresponding eFiles. After a two week wash-out period, the intraoral images were evaluated and scored for DMFT. Concordance and inter- and intra-examiner reliability were determined using the Kappa Statistic.

## Results

The intra-rater agreement and reliability across methods was 98.30% and 95.09% for examiners one and two respectively, assessed as indicating 92.79% between random agreement and perfect agreement ( $p < 0.001$ ). The high concordance level indicated that there was no statistical difference between the clinical screening and the screening teledentistry method.

## Conclusion

This study highlights the reliability of utilising teledentistry as a dental screening and diagnostic tool which can be valuable in the delivery of oral health care in South Africa especially with view to the implementation of the NHI.

## ACRONYMS

ICT:	Information and Communication Technology
NHI:	National Health Insurance
TA:	Teledentistry Assistants

## Keywords

South Africa, children, dental caries, dental screening, ICT, telemedicine, teledentistry, DMFT, oral health care, eHealth

## BACKGROUND

Teledentistry is the use of information and communication technology (ICT) to provide oral health care services and enhance oral health care delivery to rural communities that may not have access to health services. Public health services in South Africa are in the process of being overhauled to address the inadequacies and the use of ICT's has been identified as a possible tool in improving the delivery of health care. Telemedicine has been recognised as having the potential to improve access to health care, but teledentistry does not currently feature in the dental public health sector.

Teledentistry and mobile health delivery have the potential to eliminate or minimise the disparities in oral health care that exist in South Africa. The technique can be initiated in an incremental approach by 'piggy-backing' on existing telemedicine sites, thereby reducing the ICT costs for the public health sector. Stakeholders and government officials need to embrace technology to address some of the challenges that exist in the South African public health sector. This study provides evidence-based information to assist in the introduction of teledentistry in South Africa as an innovative dental screening and management tool.

The teledentistry screening method used in the present study was the store-and-forward method where the images are web-based stored and later assessed at a remote site. The teledentistry real-time consulting method can be utilized for patients visiting the dental clinics and who require specialist consultations. Real-time teledentistry consultations usually include a videoconference in which dental professionals and their patients, at different locations, may see, hear, and communicate with one another.<sup>1</sup> With real-time consultations, also known as synchronous teleconsultations, information is transferred immediately and there is a two-way interaction between the patient and the consulting specialist, which allows for immediate

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feedback from the specialist consultant. Hence, through the use of telecommunications and computer technologies, it is now possible to provide interactive access to specialist opinions in communication which is not limited by the constraints of either space or time.<sup>2</sup> Specialist care may thus be accessible in critical access areas, a contribution toward bridging the gap between demand and supply.

The most recent SA National Oral Health Survey showed that at least 80% of dental caries in children is untreated,<sup>3</sup> posing a significant public health problem.

Teledentistry has been recommended as a school screening tool to reduce the double burden of burgeoning dental caries in children and shortages of human resource in the public sector.<sup>4</sup> The technique has the potential to improve access and delivery of oral health care to children in underserved and the rural areas.

The traditional method of dental screening usually involves a registered oral health worker who carries out a visual inspection of the child's mouth and teeth by using an intra-oral mirror, a portable chair and a light source.

A registered dental assistant is often required to function as the recorder of the DMFT.<sup>5</sup> The DMFT index records decayed (D), missing (M) and filled (F) teeth. The recording and calculation of the DMFT score is a globally used and accepted measurement of the prevalence of caries.<sup>6</sup>

The DMFT is usually recorded on paper at the face-to-face dental screening session, and there is a dental charting form or data capture sheet for each child. In addition, infection control must be adhered to at all times.

On the other hand, an intraoral camera is used in teledentistry to screen for dental caries and information and communication technologies are utilised in management of the data.<sup>4</sup> This paper describes a study that compared traditional dental screening with teledentistry screening for dental caries in children.

## METHODS

The Richmond Municipality is a designated National Health Insurance pilot site, in the uMgungundlovu District of Kwa-Zulu-Natal, South Africa. Richmond is located on the southern part of the uMgungundlovu District Municipality and is approximately 38 kilometers south of Pietermaritzburg (the capital of the KwaZulu-Natal Province).<sup>7</sup> The study was carried out in Magoda, a rural area in Richmond. Three primary schools were randomly selected to participate in the study.

Prior to the initiation of the study, gateway permission to work in the primary schools was obtained from the Department of Education (DoE) and ethical clearance was approved by the Senate Research Ethics Committee at the University of the Western Cape (Ref No. 12/7/20).

In addition, information sheets were used to explain the procedures, possible risks and benefits to the parents/guardians of the participating children, and written informed consent was obtained for each participant.

For the first phase of the data collection two registered dental clinicians were designated as examiners One and Two. Both clinicians were trained, standardised and calibrated to carry out the face-to-face intra-oral examinations (traditional dental screening) which were conducted on 233 children aged between 6 and 8 years old at the selected three rural primary schools.

Headlamps, disposable tongue depressors, gauze, gloves, masks and disposable plastic picks were used. The latter instruments were used instead of standard periodontal probes to determine pit and fissure caries and to remove debris. In this way, cold sterilization was not required, which in turn saved time and ensured that infection control was maintained at all times. Each examiner independently carried out the examinations of the selected children and scored them for DMFT. A modified WHO Oral Health Assessment Form (1997) was used as the hard copy data capture sheet.

Following the face-to-face examinations, two trained and calibrated teledentistry assistants used an intraoral camera (Kodak 1500 - Carestream) and a lap top computer to capture digital images of the children's teeth. The TAs used gauze to remove any debris from the dentition. A disposable wooden tongue depressor was used to retract the cheeks, lips and the tongue to facilitate clear vision of the teeth. The intraoral camera was focused on the teeth, and the image was simultaneously viewed on a laptop.

Once a clear image was obtained, the image was captured electronically on the laptop. Images of poor quality were deleted and retaken if necessary. The images were web-based stored for each child. Four intraoral images of the upper and lower anterior teeth and the four posterior quadrants were captured (Figure 1). The imaging process was non-invasive, pain-free and there was little or no discomfort to the child. The imaging process took about 10 to 15 minutes per child. Security of data was maintained at all times by the use of protective passwords. Confidentiality and anonymity was maintained as each child was coded and no names were used.



**Figure 1.** Examples of the images captured by the TAs.

Following phase 1 of the data collection, the examiners had a 'wash out' period of two weeks. Thereafter evaluation of the intraoral images of the teeth was undertaken and scored for DMFT. All intra-oral images were randomized and blinded to keep bias to a minimum.

The data cleaned and the DMFT scores were verified. The DMFT scores were compared not only across methods (i.e. traditional dental screening (Gold Standard) versus teledentistry screening of dental caries), but also across examiners.

**RESULTS**

A total of 233 children were examined by two examiners using two different methods of dental screening, namely the traditional dental screening method and the teledentistry screening method. The resulting data were used to determine concordance and reliability between the two methods.

The study sample consisted of 131 males and 102 females. Overall, the ratio of males to female was 3:2 (56.2%:43.8%). The mean age was 6.73 years. There were significantly more male participants aged 6 and 7 years old, while females dominated the 8 year-old category. A high percentage of the children had sound teeth (69%). The traditional dental screening method found 20% to have decayed teeth whilst the teledentistry screening method recorded 21%. No children had filled teeth.

The cross-tabulation shown in Table 1 indicates the frequencies of DMFT assessments made by examiner 1 (E1) comparing the traditional dental screening method and teledentistry screening method (Image Assessor-IA1). For example, E1 rated the 1's simultaneously (3863 times) in both dental screening methods.

On 23 occasions, E1 scored a rating of 2 while IA1 scored a rating of 1. There was an almost perfect agreement of the DMFT assessments obtained from both dental screening methods with a kappa value of 0.9630 (Table 1a).

**Table 1.** Intra-rater comparisons for E1 across dental screening methods

E1	IA1					Total
	1	2	5	6	7	
1	3863	50	1	5	2	3921
2	23	1177	2	2	0	1204
5	2	0	219	0	1	222
6	0	0	0	0	0	0
7	3	0	0	4	229	236
<b>Total</b>	<b>3891</b>	<b>1227</b>	<b>222</b>	<b>11</b>	<b>232</b>	<b>5583</b>

**Table 1a.** Intra-rater Agreement and Reliability for E1 across dental screening methods

Agreement	Expected Agreement	Kappa	Std. Err.	Z	Prob > Z
98.30%	54.02%	0.9630	0.0103	93.12	0.0000

The cross-tabulation in Table 2 indicates the frequency of DMFT assessments made by E2 comparing the traditional dental screening method and teledentistry screening method (Image Assessor-IA2). For example, E2 rated the 1's simultaneously (3779 times) in both dental screening methods.

On 90 occasions, E2 scored a rating of 2 whilst IA2 scored a rating of 1. There was an almost perfect agreement of the DMFT assessments obtained from both dental screening methods with a kappa statistic of 0.8926 (Table 2a).

**Table 2.** Intra-rater comparisons for E2 across dental screening methods

E1	IA2						Total
	1	2	4	5	6	7	
1	3779	142	1	7	4	4	3937
2	90	1071	0	4	2	0	1167
4	0	0	0	0	0	0	0
5	7	0	0	212	0	0	219
6	0	0	0	0	0	0	0
7	7	1	0	0	4	229	241
<b>Total</b>	<b>3883</b>	<b>1214</b>	<b>1</b>	<b>223</b>	<b>10</b>	<b>233</b>	<b>5564</b>

**Table 2a.** Intra-rater Agreement and Reliability for E2 across dental screening methods

Agreement	Expected Agreement	Kappa	Std. Err.	Z	Prob > Z
95.09%	54.30%	0.8926	0.0103	86.46	0.0000

The intra-rater agreement and reliability for both examiners across the dental screening methods gave a kappa value of 0.9630 (98.30%) for E1 and 0.8926 (95.09%) for E2. These kappa values show an almost perfect intra-rater agreement of the DMFT assessments obtained across dental screening methods for both examiners.

The overall inter-rater agreement and reliability for the traditional screening method revealed a kappa value of 0.9279 (96.73%). There was a similar high level inter-rater agreement and reliability for the teledentistry screening method with a kappa value of 0.9480 (97.59%). Both the intra-rater and inter-rater values show high agreement with almost perfect agreement (p < 0.001).

**DISCUSSION**

In this concordance study, traditional face-to-face DMFT scores and teledentistry DMFT scores were compared for diagnostic agreement and reliability. There was a high frequency of agreement between traditional dental screening and teledentistry screening. Concordance between teledentistry and traditional dental screening methods ranged from 95.09% to 98.30% for both examiners implying that the use of teledentistry for facilitating oral health screening can be effective.

The inter-rater analysis comparing the DMFT assessments made by both examiners (E1 and E2) were found to be in almost perfect agreement for both the traditional and teledentistry screening methods. The frequency of decayed teeth scored using the traditional dental screening method was 20% and for the teledentistry screening 21% - again suggesting high agreement across methods.

The fact that both examiners had similar training, academic background and years of clinical experience, could have impacted positively on the results obtained and also suggests that they were competent to determine DMFT using both dental screening methods. However, this may not always be the case.

Decision support systems or diagnostic aids have been widely implemented to assist dental health professionals in making diagnoses using the ICT platform. If there are standard assessment tool/diagnostic protocols, this



will permit all dental professionals to utilise the teledentistry tool regardless of the level of experience. Other fields of telemedicine have utilised decision support systems successfully.<sup>8</sup>

The high concordance levels indicated that there was no statistical difference between the traditional dental screening method and the teledentistry screening method (intra-rater reliability), thus suggesting that the teledentistry screening method is a reliable alternative to the traditional dental screening method. Furthermore, this implies that intraoral images are a reliable tool to diagnose decayed, missing and filled teeth in children.

There was a high percentage of children with sound teeth and less than a quarter of children presented with decayed teeth. No children had filled teeth and many reported that they had their teeth examined for the first time during the present study.

The most recent South African National Oral Health Survey (NOHS) revealed that 80 per cent of carious lesions in children go untreated,<sup>3,9</sup> which highlights the challenges of meeting the demanding dental needs for South Africa's children, especially those living in remote and rural areas. This burden is compounded by the shortage of dental professionals that are required to provide a service to large populations.

Disagreement between the examiners was minimal across the different methods and this could be attributed to a few factors. Firstly, no radiographs were taken making pit and fissure caries difficult to determine in both methods. Secondly, the intraoral teledentistry images can be magnified with good lighting thus improving visualisation and enhancing diagnosis of sound or decayed teeth (with an exception for pit and fissure caries). It is also important to note that the intraoral images are purposefully captured to provide the assessors with the best quality to enable accurate diagnosis. Thirdly, interproximal caries is not easy to detect with either the traditional or teledentistry dental screening method unless it is obviously visible, such as a break in the surface enamel or the presence of large areas of shadowing.

The significance of the findings of the present study is that teledentistry can be used as a valuable alternate to the traditional dental screening face-to-face method especially when screening large populations of children in rural areas, particularly in Sub-Saharan Africa where poverty and the delivery of oral healthcare is a great challenge. South Africa is in an on-going process in the endeavour to address the disparities within the health system.

One of the key aims of the NHI is to re-engineer the way in which school-based primary health care services are provided, and teledentistry has a significant role to play. In this regard, it may be a strategic opportunity to introduce the technique into the school-based primary health care policy, so as to improve oral health promotion and service delivery.

Panat et al found teledentistry to be a good tool for screening dental caries in schoolchildren, enabling their differentiation into categories of high risk or low

risk patients.<sup>10</sup> This risk triage can assist dental professionals in tailoring curative and preventive packages to assist communities in combating dental caries in schoolchildren.

Young children need to be aware of the importance of good oral health so that they can prevent dental caries, early tooth loss and other oral diseases. Risk assessment is now viewed as the critically important step in the clinical decision-making process of managing dental caries.<sup>11</sup> For teledentistry, caries risk assessment can effectively manage and triage patients for treatment planning, prevention, and establishing follow-up and recall times.

The combination of teledentistry with the caries risk assessment strategy can be significant in providing a synergy between preventive and curative oral health care for children in critical access communities.<sup>11</sup> Therefore, teledentistry should be strategically engineered into the school oral health screening programmes.

The categorization of the caries risk factors will then allow for focused recommendations to minimise the risk of children developing new carious lesions and/or the progression of existing lesions in the future,<sup>12</sup> thereby promoting oral health care and preventing further disease. This further highlights the potential value of the teledentistry screening method as it may be envisaged as a more cost-effective method to screen large populations of children.

The proposed introduction of the National Health Insurance (NHI) aims to ensure that everyone has access to appropriate, efficient and quality health services regardless of their socio-economic status.<sup>13</sup> Appropriateness is one of the guiding principles of the NHI and refers to adopting new and innovative health service delivery models that focus on local needs.<sup>13</sup> It may be a viable option for the Department of Health to consider teledentistry for implementation into the NHI and the next National Oral Health Survey (NOHS). In addition, one of the objectives of the NHI is to strengthen the under-resourced and strained public sector so as to improve health systems performance.<sup>13</sup> Teledentistry is an intervention that can enhance opportunities for the new primary healthcare model and has the capacity to take service delivery and accessibility to new and improved levels.

The teledentistry screening method will eliminate the need for instrumentation (like mouth mirrors and probes) and infection control as cold sterilization of the instruments will not be required. Furthermore, National Oral Health Surveys often require the deployment of a large number of calibrated dental professionals to carry out visual face-to-face examinations. Teledentistry screening can utilise trained and calibrated non-dental personnel (community health workers or nurses for example that are already based in the communities) to capture the intraoral images of the school children and the web-based stored images can then be assessed by the dental professionals at a distant site in their own time (community health dentists can be utilised for this role). Therefore, teledentistry screening can potentially greatly reduce the human resources required and save travel time so that dental professionals make better use of their clinical training and expertise in the dental clinics.

## CONCLUSION

The present study has shown the reliability of teledentistry as a dental screening tool. Once initiated, teledentistry has the potential to grow and develop within its own versatility and various adaptations. For example, it can be used for a variety of online dental information and education purposes, for electronic consumer medical and health information, dentist-laboratory communication, patient consultations, specialist referrals and for remote patient monitoring or home-health care. All of which have great potential to enhance dental education and importantly to enhance the delivery of oral health care in South Africa.

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## ERRATUM

The November issue of the Journal carried an article which was not correctly categorised. The paper *Cervical restorations useful when assessing gingival and periodontal health* was published on page 633 under the category Industry News.

The correct category is Clinical Communication. Sincere apologies to the author.

Reference: 2018;73(10):633.

# Research misconduct and publication ethics: a South African perspective\*

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## SUMMARY

Research misconduct is a global problem that tarnishes the reputation of researchers and research institutions and inevitably compromises the independence, integrity and credibility of the scientific record. Biomedical researchers, like all other professionals, are susceptible to pressures and temptations, which may result in their engaging in questionable research practices or even deliberate misconduct.

Preventing research misconduct is the first step in preserving and restoring the integrity of the scientific record. Understanding the causes of and the contributing factors associated with research misconduct is essential when devising preventative strategies. With reports of misconduct on the increase in South Africa and elsewhere, there is clearly a need to better equip researchers with the knowledge they need to conduct responsible, ethical research and to bring to their attention the most common forms of research misconduct (be it intentional or not) that are plaguing the scientific community.

## INTRODUCTION

Over the past twenty-odd years, South Africa has witnessed a substantial growth in the number of scientific research studies conducted here, as well as the number of publications that flow from these studies, evidenced by the fact that in 2010 the country was ranked 33<sup>rd</sup> in the world in terms of the number of research publications produced by South African scientists, the highest ranking yet achieved.<sup>1</sup> This increase has been influenced strongly by the establishment of the NRF in 1999, an initiative having the objective to support and promote research.<sup>2</sup>

Incentives that reward prolific researchers and the tertiary or other institutions to which they belong have similarly raised publication rates. The Department of Higher Education and Training awards subsidies for publications appearing in accredited South African journals, as well as international, ISI and IBSS-accredited journals, books and book chapters, further incentivising research outputs.

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\*This article is based on the Masters dissertation of the first author (MPhil (Medical Law and Ethics) University of Pretoria, 2016).

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## ACRONYMS

<b>CADC:</b>	Complaints and Advisory Disciplinary Committee
<b>COPE:</b>	Committee on Publication Ethics
<b>FFP:</b>	Fabrication, Falsification, and Plagiarism
<b>ICMJE:</b>	International Committee of Medical Journal Editors
<b>NHREC:</b>	South African National Health Research Ethics Council
<b>ORI:</b>	Office of Research Integrity
<b>QRP:</b>	Questionable Research Practices
<b>RCR:</b>	Responsible Conduct of Research
<b>REC:</b>	Research Ethics Committee
<b>USPHS:</b>	US Public Health Service
<b>WAME:</b>	World Association of Medical Editors

As a result, academics and researchers at universities and other institutions are placed under immense pressure, and are often compelled to 'publish or perish' in order to establish themselves or to achieve promotion.

Against the background of this massive drive to increase output, researchers who lack the necessary skills and knowledge may end up facing moral and ethical challenges and, as a result, may even commit research misconduct.

Research misconduct is a global problem that tarnishes the reputation of researchers and research institutions, and inevitably compromises the independence, integrity and credibility of the scientific community.<sup>3</sup> Studies on the prevalence of research misconduct in the developing world, particularly in Africa, are scarce.<sup>3,4</sup> However, in a recent study conducted among researchers in Nigeria, 68.9 % of the respondents admitted to having committed some form of scientific misconduct.<sup>5</sup>

In order to curb growing incidences of research misconduct, a culture of research integrity should be fostered in South Africa. In light of the need to better equip researchers with the knowledge they require to conduct responsible, ethical research and to bring to their attention the most common forms of research misconduct (be it intentional or not) that are plaguing the scientific community, this article examines forms of research misconduct and highlights ways of combating the practice.

## FORMS OF RESEARCH MISCONDUCT

Core values such as accountability, honesty and trustworthiness are indispensable when conducting, writing up, and publishing research. Research integrity, therefore, does not only involve adhering to ethical rules and regulations.<sup>6</sup>



At the 2<sup>nd</sup> World Conference on Research Integrity held in Singapore in 2010, the “Singapore Statement on Research Integrity” was adopted. The document was developed with the intention of challenging researchers, governments and organisations to develop more comprehensive codes, standards and policies that would promote research integrity both locally and globally.<sup>7</sup>

According to the Singapore Statement, the four basic principles fundamental to research integrity are: honesty in all aspects of research; accountability in the conduct of research; professional courtesy and fairness in working with others, and good stewardship of research on behalf of others.<sup>8</sup>

The document further highlights the fundamental professional responsibilities to which investigators should adhere when conducting and publishing research. Every researcher, both established and novice, should be familiar with the contents of the Singapore statement, as well as with other important guidelines and policies on good publication practice, as listed in Table 1.

Research behaviour may broadly be categorised as: deliberate misconduct, often defined as fabrication, falsification, and plagiarism (FFP); questionable research practices (QRP); and responsible conduct of research (RCR).<sup>9-12</sup> All institutions and researchers should strive to meet RCR as the ideal standard of research, deliberate misconduct should be avoided at all costs and QRP refers to research practices that fall somewhere between the two extremes of FFP and RCR.<sup>10</sup>

Deliberate fabrication or falsification of data undoubtedly constitutes gross scientific misconduct. Plagiarism at a tertiary and post-graduate level is inexcusable, and every institution of higher learning must have in place strict policies on this problem.

Other than FFP, deliberate misconduct also includes: falsification of credentials; duplication of publications; inaccurate author representation; deviation from or failure to adhere to a proposed protocol without proper permission; deception when writing research protocols; deception in the implementation of research; conducting research without the clearance of a Research Ethics Committee (REC) or similar body; failure to obtain informed consent; breach of confidentiality; as well as any unjustifiable deviations from the accepted ethical standards of research.<sup>13,14</sup>

QRP is described as any activity that may be detrimental to the research process but does not directly damage the integrity of the research itself.<sup>10</sup> QRP includes but is not limited to: misrepresentation, i.e. publishing results of the same experiment in several partial papers, with the intention of increasing the number of publications; inaccuracy, i.e. improper use of statistics and data analysis, careless citational errors, as well as inadequate abstract or summary writing; and, lastly, conflicts of interest and bias, i.e. presenting evidence or making decisions that are not scholarly or scientifically justifiable.<sup>10</sup> Honest error, honest difference in opinion, and errors in interpretation do not constitute research misconduct.<sup>14-16</sup>

**Table 1.** Important Guidelines and Policies on Good Publication Practice

Guideline/Policy	Version/Last Updated	Available online at:	Date last accessed
COPE Guidelines on good publication practice	1999	<a href="http://publicationethics.org/files/u7141/1999pdf13.pdf">http://publicationethics.org/files/u7141/1999pdf13.pdf</a>	29-08-2016
COPE How to handle authorship disputes: a guide for new researchers	2003	<a href="http://publicationethics.org/files/2003pdf12_0.pdf">http://publicationethics.org/files/2003pdf12_0.pdf</a>	29-08-2016
COPE Retraction Guidelines	2009	<a href="http://publicationethics.org/files/retraction%20guidelines.pdf">http://publicationethics.org/files/retraction%20guidelines.pdf</a>	26-08-2016
Text Recycling Guidelines (biomedcentral.com)	2016	<a href="https://publicationethics.org/resources/guidelines">https://publicationethics.org/resources/guidelines</a>	06-03-2018
COPE A Short Guide to Ethical Editing for New Editors	2016	<a href="https://publicationethics.org/resources/guidelines">https://publicationethics.org/resources/guidelines</a>	06-03-2018
COPE Ethical Guidelines for Peer Reviewers	2017	<a href="https://publicationethics.org/resources/guidelines">https://publicationethics.org/resources/guidelines</a>	06-03-2018
COPE Principles of Transparency and Best Practice in Scholarly Publishing	2018	<a href="https://publicationethics.org/resources/guidelines">https://publicationethics.org/resources/guidelines</a>	06-03-2018
COPE Various flowcharts and E-seminars on dealing with and handling suspected research and publication misconduct	n/a	<a href="http://publicationethics.org/resources/guidelines">http://publicationethics.org/resources/guidelines</a>	29-08-2016
International Society for Medical Publication Professionals: Good Publication Practice for Communicating Company-sponsored Medical Research: the GPP2 guidelines	2009	<a href="http://www.bmj.com/content/339/bmj.b4330">http://www.bmj.com/content/339/bmj.b4330</a>	29-08-2016
International Society for Medical Publication Professionals: Good Publication Practice for Communicating Company-sponsored	2015	<a href="http://annals.org/article.aspx?articleid=2424869">http://annals.org/article.aspx?articleid=2424869</a>	29-08-2016
Avoiding plagiarism, self-plagiarism, and other questionable writing practices: A guide to ethical writing by Miguel Roig. (Posted on the Office of Research Integrity website)	2015	<a href="https://ori.hhs.gov/sites/default/files/plagiarism.pdf">https://ori.hhs.gov/sites/default/files/plagiarism.pdf</a>	29-08-2016
WAME Recommendations on Publication Ethics Policies for Medical Journals	2016	<a href="http://www.wame.org/about/recommendations-on-publication-ethics-policies">http://www.wame.org/about/recommendations-on-publication-ethics-policies</a>	29-08-2016
ICMJE Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals	2017	<a href="http://www.icmje.org/recommendations/">http://www.icmje.org/recommendations/</a>	06-03-2018
The Office of Research Integrity Website: Various E-Seminars, online modules and guidelines relating to publication ethics and research misconduct	2016	<a href="http://ori.hhs.gov/">http://ori.hhs.gov/</a>	29-08-2016

The Committee on Publication Ethics (COPE) is an internationally renowned organization that provides resources to editors and publishers on all aspects of publication ethics.<sup>17</sup> It is the opinion of the authors of this paper that every journal editor and researcher should familiarise themselves with COPE's code of conduct, and other resources available on their website.

### Fabrication and Falsification

Fabrication is defined as the 'making up' or fabrication of data or results and recording or reporting these with the deliberate intention of deceiving the scientific community.<sup>16,18</sup> Fabricated data may be: used in the publishing of papers in scientific journals; presented at local and international scientific gatherings or conferences; used to fraudulently obtain research grants or patents.<sup>6</sup>

Falsification includes fabrication, and refers to the intentional suppression, distortion or manipulation of true scientific findings obtained from experimental or observational research, without any sound scientific or statistical justification.<sup>6,18,19</sup>

Other forms of fabrication and falsification include selective reporting of results; failing to report results or findings that conflict with current reports in the literature; and manipulating images with the intention of obscuring or eliminating crucial information.<sup>18-20</sup>

It goes without saying that the intentional publication of fabricated and falsified research undermines the reliability and the integrity of the research record.<sup>10</sup>

### Plagiarism

There are many overlapping definitions of plagiarism in the literature. The most popular being that of the Office of Research Integrity (ORI). According to the ORI, plagiarism is "the appropriation of another person's ideas, processes, results, or words without giving appropriate credit".<sup>16</sup>

The authors of this paper suggest combining that definition with that of the World Association of Medical Editors (WAME), thus defining plagiarism as:

The use of another person's unpublished or published ideas, words, results, processes or any other intellectual property (including those obtained through confidential review of research proposals and manuscripts) without attribution or permission, and presenting them as your own, new or original.<sup>16,20</sup>

As per the definition proposed above, so-called 'borrowed' information is not limited to written texts (i.e. articles, books, dissertations, theses, etc.), but also includes other intellectual property, such as audio-visual presentations, multimedia and online sources, for instance, videos and websites, spoken text such as speeches and lectures, ideas, research manuscripts and methods, or any other privileged communication.<sup>6,21</sup>

Another hotly-contested topic of discussion falling under the ambit of FFP is self-plagiarism. Self-plagiarism is when an author republishes work in its entirety or reuses portions of previously-published work or data on the same

topic in another publication, without specifically acknowledging it.<sup>20,22</sup> *Prima facie* 'self-plagiarism' indeed is an oxymoron 'How can one steal from oneself?'.<sup>23,24</sup>

Nevertheless, there are complex variables at play in the arena of self-plagiarism, including copyright law; how much text re-use is permissible; when to cite; as well as the appropriate use of quotation marks.<sup>23</sup>

Self-plagiarism can be categorised broadly into: redundant or duplicate publications; 'double-dipping' or academic self-plagiarism; 'salami slicing'; and text recycling.<sup>10,24</sup> An excellent article written by Roig<sup>24</sup> highlights 28 comprehensive guidelines dealing with plagiarism, self-plagiarism and ethical scientific writing. Roig's paper is a must-read for every researcher - both novice and established.

Some of the guidelines relating to self-plagiarism discussed in the article include the following:

- Any manuscript being submitted for publication that has already been previously disseminated (i.e. as a published article in a journal, presentation at a conference or scientific meeting, or published on the internet) must inform both the editors and the readers of the previous dissemination.<sup>24</sup>
- Authors of single complex studies should as far as possible try to present data as a cohesive whole, instead of partitioning it into multiple separate papers.<sup>24</sup>
- Authors should familiarise themselves with the basics of copyright law, as extensive paraphrasing or quoting from a book may constitute copyright infringement.<sup>24</sup>
- Even though there are some instances where text recycling is permissible, authors should avoid reusing their own previously-published text, unless it is properly paraphrased, placed within quotation marks and, of course, correctly cited.<sup>24</sup>

Double-dipping or academic self-plagiarism occurs when an entire research report, dissertation or thesis (or a substantial part of this work) is submitted in order to fulfil a course or degree requirement, even though that work had been submitted previously to satisfy the requirements for another programme at a different university or academic institution.<sup>24</sup>

Plagiarism may not have a significant impact on the reliability of the research record (provided that the original work being plagiarised is scientifically accurate).<sup>10</sup> It does, however, result in funds being wasted for review of the publishing of plagiarised work; furthermore, it undermines trust and collegiality within the scientific community.<sup>10</sup>

There are various software packages on the market that are able to detect plagiarism, such as Turnitin@<sup>26</sup> and PlagScan@.<sup>27</sup> Such programmes are used routinely by institutions of higher learning to check the originality of academic papers, dissertations and theses. As remarked previously, every academic institution must have a strict plagiarism policy in place, and every researcher affiliated with such institutions should be made aware of such policies.

## Inappropriate Authorship

Biomedical issues are complex and often require the expertise of a research team. Furthermore, technological advances have allowed researchers from all over the world to collaborate.<sup>24</sup> Such projects invariably result in multi-authored publications.

There is no universal definition for 'authorship', however, according to the WAME, in order for a researcher to qualify for authorship he/she should make a significant intellectual contribution to a study (i.e. contribute to writing the manuscript, as well as reviewing the final draft).<sup>20</sup>

Questions regarding authorship that often arise include: Who should be an author, and in what sequence? Should people in power such as heads of departments receive automatic authorship? Who should receive acknowledgement? Such matters should be resolved early on in the research process, so as to avoid any disputes which may delay the publishing of a paper.<sup>20</sup> A number of professional societies, and many scientific journals, have published guidelines relating to authorship.

The guidelines published by the International Committee of Medical Journal Editors (ICMJE) are by far the most popular, and have been adopted by more than 3000 scientific journals worldwide.

According to the ICMJE, an individual only qualifies for authorship if he/she satisfies all of the following four criteria:

1. "Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; **and**
2. Drafting the work or revising it critically for important intellectual content; **and**
3. Final approval of the version to be published; **and**
4. Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved".<sup>28</sup>

Furthermore, the main author should be able to identify which co-authors are responsible for different parts of the work.<sup>28</sup> Individuals who do not meet all of the criteria mentioned above should not be listed as authors, but rather their contributions acknowledged.<sup>28</sup> Other individuals who may be acknowledged include those involved in: data collection; scientific advisory; critical review of the proposal, as well as in technical editing, language editing, and proof-reading of the manuscript.<sup>28</sup>

Other popular terms coined under the ambit of inappropriate authorship include, 'Ghost Authorship' and 'Honorary' or 'Gift' authorship. Honorary or gift authorship basically entails including as an author an individual who does not meet the authorship criteria highlighted above.

This practice is common in academe, where junior staff members are coerced into including heads of departments and senior staff members as co-authors in their publications. The pressures of publishing, getting funding, promotions and gaining respect from peers, further exacerbate this practice.<sup>29,30</sup>

A ghost author is an individual who has made a substantial contribution to a work, but who is not named as an author.<sup>31</sup> This practice has become increasingly popular in the pharmaceutical and biomedical industry. Medical writers are paid large sums of money to write articles detailing results of clinical drug trials, and are not credited with authorship or acknowledgement.<sup>6</sup>

The idea is that these 'ghost' writers are paid by such companies in order to ensure these articles are written in a way that portrays their product in a favourable light.<sup>32</sup> Well-known and respected academics and expert researchers in the field are then recruited to write a 'balanced' review of the product.<sup>24</sup> These researchers, however, are furnished with a draft paper (already written to specification by the ghost author) in order to facilitate the write-up.<sup>32,24</sup> Using the names of well-known expert researchers improves the 'credibility' of these papers, thus streamlining peer-review and publication.<sup>32</sup>

In order to preserve the credibility and accountability of the scientific record, researchers, research and academic institutes as well as scientific journals must encourage authors to adhere to currently-accepted criteria for authorship.

## Conflicts of interest and Bias

A conflict of interest arises when an individual's relationship to an organization/industry or other party has the potential to compromise or to bias professional judgement or objectivity in the conduct of scholarly or scientific research.<sup>24,29</sup> This relationship need not necessarily be a personal or financial one.<sup>24</sup> Furthermore, a conflict of interest need only imply the potential for bias, not necessarily a likelihood.<sup>29</sup> According to Steneck<sup>10</sup>, bias means "making decisions or presenting evidence for other than scientific or scholarly reasons"<sup>10</sup>. The basis of scientific research is objectivity, and once objectivity is influenced by bias, research is compromised.

Conflicts of interest may be categorised broadly as either tangible or intangible.<sup>29</sup> Intangible conflicts of interest are often overlooked and include, among others: conflicts of interest at an individual level; intellectual bias and conflicts of conscience.<sup>29</sup> Conflicts of interest at an individual level relate to the pressures of publishing, getting funding, academic promotions and earning the respect of peers.<sup>29,30</sup> Such pressures may lead to diminished objectivity, which may result in bias.<sup>29</sup> Intellectual bias includes but is not limited to unethical peer-review, which will be discussed further in this paper.<sup>29</sup> Conflicts of conscience occur when a personal belief influences objectivity in research; for example, personal or religious views may cloud a researcher's objectivity on a study involving embryonic stem cell research.<sup>29</sup>

Tangible or measurable conflicts of interest usually involve financial gain or benefit.<sup>29</sup> Financial conflict of interest and its effect on academe are aptly summarised in this statement by Johnston:<sup>33</sup>

"Traditionally, academic biomedical research institutions and for-profit companies have had different missions. Academic institutions have focused on teaching, research, and public service, whereas companies have



focused on generating revenue through commercial activities. But the distinction between their missions is becoming blurred now that academic institutions and their employees have opportunities to make significant amounts of money – from research contracts, equity holdings, patents, and other relationships with industry...<sup>33</sup>

Such conflicts of interest may compromise the quality of biomedical research, which may, in turn, result in harming research subjects, patients or anyone who relies on such research.<sup>33</sup> Several American professional societies and scientific journals have adopted a 'zero tolerance' policy when dealing with financial conflicts of interest.<sup>29,34</sup>

Non-financial conflicts of interest include any relationship that could inappropriately influence or have the potential to influence professional judgment, such as personal relationships (i.e. close personal friends or immediate family members). Conflicts of interest, however, are not only limited to researchers. Journal editors as well as peer reviewers also need to disclose relevant conflicts of interest and, if need be, withdraw from the review and selection process if there is potential for bias.<sup>28</sup>

Now that we have outlined the different forms that research misconduct may take, we turn to ways in which the scientific community may combat research misconduct.

## COMBATING RESEARCH MISCONDUCT

### Ethical Peer-review

The peer-review process is considered to be the benchmark of the scientific publication process and is critical in ensuring the dissemination of sound scientific knowledge (i.e. it allows for a fair hearing of a manuscript among peers in the scientific community).<sup>24,29</sup> It is unethical to allow a flawed paper devoid of any scientific merit to pass unchallenged into the peer-reviewed literature.<sup>34</sup>

Peer-reviewers usually are experts on a particular scientific topic, and are required to have at least: a history of having conducted and published original research; formal training in the relevant science; as well as experience in critically appraising manuscripts.<sup>24</sup>

The following guiding ethical principles should be adhered to during the peer-review process:

- Manuscripts submitted to journals prior to publication are privileged communications and are the intellectual property of the authors. Both editors and peer-reviewers must, therefore, treat manuscripts as confidential documents.<sup>24,28,34</sup> Peer-reviewers are not allowed to cite or use any data from a manuscript that they have reviewed, before it is officially published.<sup>35</sup>

Moreover, peer-reviewers should keep the outcome of their reviews confidential, and manuscripts should not be discussed with colleagues.<sup>24</sup> If a manuscript is rejected, it is best practice for journals and peer-reviewers to delete all copies of it from their editorial systems, unless otherwise required by regulations.<sup>28</sup>

Peer-reviewers should provide objective, unbiased, timely, accurate, clear, concise, justifiable and constructively critical reports. Furthermore, reviewers should uphold the precepts of collegiality and refrain from making rude, snide, sarcastic and argumentative remarks when writing reviews.<sup>34,36</sup>

- Journals have different policies regarding whether the review process is open or blinded, generally the identity of the reviewers are known to the editor, but this information is not released to the authors, to fellow reviewers, or third parties.<sup>34</sup> This anonymity allows reviewers to provide a critical and honest review without the risk of victimisation from their peers.<sup>34</sup>
- Timeliness is extremely important in the peer-review process. Journals require reviewers to review a manuscript within a specific time-frame. It is unfair to the author and to the journal to accept a paper for review if it cannot be reviewed within the specified time-frame, as there always is the risk of the manuscript becoming outdated. Furthermore, it is unethical to rush a review; to perform careless and superficial reviews; or to review a manuscript if one does not possess the necessary subject expertise required to do so.<sup>36</sup>
- When reviewing a manuscript the following factors should be considered: the suitability for publication in the journal; the importance and novelty of the science; the appropriateness of the research design; the quality and validity of the data; the interpretation of the data; appropriate statistical analysis; as well as the reliability and validity of the conclusions drawn from the study.<sup>34</sup>

Editors and reviewers should not exclude from consideration credible studies with inconclusive findings or credible studies that challenge the existing dogma.<sup>28,34</sup> The main aim of peer-review is to focus on the scientific credibility of the manuscript and not minor editorial problems, unless the grammar used renders the manuscript erroneous, unclear or ambiguous.<sup>34</sup>

- As alluded to earlier, peer-reviewers should declare all real and perceived conflicts of interest and recuse themselves from the peer-review process if they have a real or perceived conflict of interest that may compromise the objectivity of the review, or that may appear to compromise its objectivity.<sup>28,34,36</sup>
- Most journals have strict policies and ethical guidelines for studies conducted on human or animal subjects. Ensuring that a study complies with journal policies and institutional REC policies as well as national regulations and guidelines governing research on humans, is an important part of the peer review process.<sup>34</sup>
- Lastly, journals should publish accurate descriptions of their peer-review policies (i.e. reviewer selection, review completion times and appeals processes), as well as annual audits of acceptance rates, publication times, and other performance data.<sup>35</sup>

An academic/intellectual conflict of interest occurs when a reviewer interferes with the peer-review process for some type of intangible personal gain.<sup>29</sup> If the content of a

manuscript is too closely related to the work of a reviewer (published or unpublished), then there is always a risk of bias. In such cases, it is best practice for a reviewer to contact the editor, and recuse him/herself from the review process.

If a reviewer suspects serious breaches in publication ethics and/or research misconduct, he/she should notify the editor in confidence.<sup>24</sup> The editor should then decide whether an official investigation is warranted.

Until the investigation is finalised, both the editor and the reviewer should be thoughtful and extremely discreet in their discussions and deliberations as the consequences for authors, the journal and the scientific record could be calamitous.<sup>34</sup>

### Maintaining the integrity of the scientific literature

The drive to publish or perish coupled with financial and professional incentives to conduct research, as well as the media's recent portrayal of the dangers associated with biomedical research, against the backdrop of an increase in the number of reported cases of research misconduct have led to increased public and regulatory scrutiny of biomedical research.

This concern is not unwarranted as there is consensus in the scientific community that the number of reported cases of research misconduct, as well as the number of journal retractions is unacceptably high.

The first step in repairing and maintaining the integrity of the scientific literature would be to preserve and restore the quality of biomedical research. The scientific literature is only as reliable as the trustworthiness and calibre of the research team, therefore, the development and training of ethical, adequately-qualified researchers is crucial in fighting the battle against scientific misconduct.

At the request of the United States' Office of Research Integrity, the Institute of Medicine in collaboration with the National Research Council's Division on Earth and Life Studies formed the Committee on Assessing Integrity in Research Environments in 2001, which has proposed recommendations to improve research Integrity. Some of these are listed below:

- Funding agencies should establish research grants dedicated to funding future research aimed at investigating factors that influence integrity in research.<sup>37</sup>
- Research institutions should develop and implement comprehensive programmes designed to promote integrity in research, such as educational short courses aimed at enhancing responsible conduct of research.<sup>37</sup>
- The integrity of these research environments should be evaluated and enhanced through a process of continuous self-assessment and external peer review.<sup>37</sup>

Nevertheless, it is unreasonable to expect the research process to be completely error-free. How does one manage a situation where a fraudulent or inaccurate study manages to slip through the cracks in the system and

is published in the scientific literature? According to the COPE, journal editors should consider retracting a publication if:

- There is clear evidence that the findings are unreliable, either as a result of deliberate misconduct or honest error.<sup>38</sup>
- The findings have been published previously (without proper cross-referencing, permission or justification).<sup>38</sup>
- There is evidence of plagiarism.<sup>38</sup>
- There is evidence of unethical research.<sup>38</sup>

Journal editors may issue an expression of concern if:

- There is inconclusive evidence of research or publication misconduct.<sup>38</sup>
- There is evidence that the findings of a study are unreliable but the affiliated institution will not conduct an investigation.<sup>38</sup>
- There is reason to believe that an investigation into alleged misconduct related to the publication either has not been, or would not be, impartial, fair or conclusive.<sup>38</sup>
- An investigation is underway, but there will be a considerable amount of time before the outcome will be made available.<sup>38</sup>

Journal editors should issue a correction if:

- A small part of an otherwise reliable publication proves to be misleading, due to honest error.<sup>38</sup>
- If a deserving author has been omitted or somebody who does not meet authorship criteria has been included in the author list.<sup>38</sup>

Fraudulent publications should ideally be retracted by the author(s) themselves; however, editors may retract publications (or issue expressions of concern) if all or some of the authors refuse to cooperate.<sup>38</sup>

Furthermore, affiliated research institutions should take on the responsibility of carefully scrutinising all other publications by the guilty authors for possible misconduct.<sup>39</sup>

A published retraction notice should: be clearly identified as a retraction; clearly identify the title and authors of retracted article; be published as soon as possible; include the reasons for retraction (clearly distinguishing misconduct from honest error), ideally quoting the findings of the investigations; be linked to the retracted article wherever possible (i.e. in all electronic versions); be freely available to all readers; state who is retracting the article; and avoid statements that are potentially defamatory or offensive.<sup>38,39</sup>

Retraction notices must also appear in all electronic sources such as the journal website; bibliographic databases and electronic search engines.<sup>38,39</sup> Furthermore, it is imperative that journal editors make it mandatory for

authors submitting papers to journals, to check that they have not cited any retracted articles in their reference lists.<sup>39</sup>

Scientists have a moral duty and a professional obligation to warn the scientific community of these tainted publications, so as to prevent contamination of the literature through inadvertent citation of such publications.<sup>39</sup> With technological advances such as electronic journals readily accessible on the internet, scientific findings are globally disseminated. However, the regulation and enforcement of ethical research is local.<sup>39</sup> Cleansing the medical literature of tainted publications is a complex task that requires a collective effort on the part of scientists, research institutes and government institutions.

### Managing allegations of research misconduct

The United States was one of the first countries in the world to establish a government system for evaluating allegations of scientific fraud and misconduct. In March 1989, the US Congress established the Office of Scientific Integrity and in 1992 this office was consolidated into what is today known as the Office of Research Integrity (ORI).<sup>40</sup>

The ORI is considered to be an authority on promoting research integrity and managing research misconduct and many countries around the world, including South Africa, use their policies and guidelines as a benchmark.

Even though the ORI only deals with cases of misconduct relating to federally-funded research, its influence has extended informally to other research<sup>39</sup>, and many research and academic institutes both in the US and internationally have adopted the ORI's administrative procedures for handling research misconduct. Furthermore, many South African Universities are involved in collaborative research that is funded by the US Public Health Service (USPHS). These institutes are legally compelled to notify the ORI of any alleged research misconduct involving USPHS funds, and to develop and implement processes for responding to such allegations that are consistent with US Federal regulations.<sup>41</sup> In compliance with section 72 of the National Health Act 61 of 2003, the South African National Health Research Ethics Council (NHREC) established the Complaints and Advisory Disciplinary Committee (CADC).

This committee is mandated to: adjudicate complaints about the functioning of RECs; to hear a complaint from a researcher who believes that a REC has discriminated unfairly against him; to refer matters involving allegations of violation of ethical or professional rules or standards by a health care provider to the relevant statutory health professional council or body; to institute remedial measures and disciplinary action where warranted, and to facilitate compliance with legal, ethical and professional norms and standards as required for responsible conduct of research.<sup>42</sup>

In South Africa, the regulatory framework for dealing with allegations of research misconduct starts at an institutional level through the RECs; followed by the NHREC and its CADC; thereafter the matter may be referred to statutory professional bodies and, lastly, if necessary legal processes may be instituted.<sup>43</sup>

The CADC published a guideline for the management of complaints in 2012, and later updated it in 2015. The content of these guidelines is of vital importance as it outlines in detail the processes that should be followed by the CADC when dealing with complaints. All members of the scientific community in good standing are morally and professionally obliged to report suspected cases of misconduct to the relevant authorities. In the NHREC's Annual Reports for 2014/2015 and 2015/2016 it was reported that the CADC handled as few as seven complaints during the period.<sup>42,44</sup> This implies that the bulk of research misconduct cases are resolved at an institutional level (by RECs) without the intervention of the CADC. The authors of this paper, however, are of the opinion that this figure is far too low, and we suspect that perhaps the existence, duties and functions of the CADC are not well publicised among the research community.

### CONCLUDING REMARKS

Like other professionals, scientists are also susceptible to pressures and temptations,<sup>45</sup> which may result in their engaging in questionable research practices or deliberate misconduct.

Research misconduct is a very real problem plaguing the scientific community, and the damage that it inflicts on the integrity and credibility of the scientific record, and on public health and opinion, is detrimental and extremely difficult to remedy.

This article outlined a number of forms that research misconduct may take, and it highlighted strategies to fight this scourge, strategies which should be aimed at preventing misconduct, rather than at repairing the damage it inflicts. Our aim, therefore, is to expose the reader to current policies/guidelines relating to the management of research misconduct, both globally and in South Africa.

By sensitising readers to the problem of research misconduct, and by highlighting current and future strategies which may be applied to fight this blight, we hope to have contributed in a small way to the preservation of the scientific record.

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# Unusual intraorbital foreign body impactions, a case report

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## INTRODUCTION

Foreign body impalements in the maxillofacial region are not uncommon, but intra-orbital foreign bodies (IOFBs) impactions are rare, the frequency being one in every six patients with orbital trauma.<sup>1</sup> IOFBs can be classified into intra-ocular and extra-ocular foreign bodies, the latter being an object that lies within the orbit but outside the ocular globe.<sup>2</sup> Intra-ocular foreign bodies can lead to globe rupture, infection, retinal toxicity, and vision loss, and thus detection is of the utmost importance, with imaging playing a key role. These foreign bodies (FB) pose a diagnostic challenge due to their size, difficulty of access and their close relation to vital structures. Ocular acuity and mobility should be investigated on admission as they are frequently associated with ocular trauma.<sup>2</sup>

IOFBs may result from trivial accidents, gunshot, industrial accidents,<sup>2</sup> interpersonal violence e.g. knife impactions. When an impalement injury occurs in the craniofacial region it is usually referred to as Jael's Syndrome, based on the biblical story of a "nail" being hammered into the temple of a sleeping man (Judges IV, v.21).<sup>3</sup>

This article reports a case of a patient presenting with an orbito-infratemporal foreign body, (an extraocular foreign body that extends into the infratemporal fossa), resulting in restricted mouth opening. To our knowledge, impaction with this type of foreign body, a door handle, has not been previously reported.

## CASE REPORT

A 34 year old male presented to Chris Hani Baragwanath Academic Hospital (CHBAH) with complaints of pain and irritation below the left eye. He gave a history of falling against a door, striking one side of his face five days prior to presentation. The door handle had been broken but the fractured piece had not been found. He had consulted his local clinic immediately after the injury with bleeding from the face in the infraorbital area, which was managed at the clinic, and he had then been referred to an ophthalmologist.

## ACRONYM

<b>CHBAH:</b>	Chris Hani Baragwanath Academic Hospital
<b>CT:</b>	Computed Tomography
<b>FBs:</b>	Foreign Bodies
<b>IOFBs:</b>	Intra-orbital Foreign Bodies
<b>MRI:</b>	Magnetic Resonance Imaging
<b>OMFS:</b>	Oral and Maxillofacial Surgery

The eye was assessed in the Ophthalmology Department at CHBAH a day after injury when no abnormalities were detected. The patient was discharged with analgesics and an ointment. He reported back to Ophthalmology after two days with severe pain and irritation and was then referred to the Oral and Maxillofacial (OMFS) Department for further management.

On clinical assessment a small healing scar, about 5mm. in length, was noted on the lower eyelid (Fig 1). The orbital rims were intact and non-tender on palpation. The globe of the eye was intact and vision was normal from both eyes. Eye movement was not restricted and there was no diplopia in all gazes. However there was slight pain on superior gaze. He also suffered a restricted mouth opening of 2.5cm due to discomfort.



Figure 1 and 2. Pre-operative view and lateral skull view

Lateral and postero-anterior radiographic views of the skull were taken (Fig 2). On examination, a radiopaque object about 3cm in length was evident in the infra-orbital region. A computed tomography (CT) scan was requested to assess the extent of the injury and the tissues involved (Figs 2 and 3). The report indicated that there was a metal object in the orbit which was extending into the infra-temporal fossa through the inferior orbital fissure, but neither fractures nor vascular injuries were diagnosed.

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**Figure 3.** Coronal view of the CT-Scan indicating the door handle above the infra-orbital rim.

The patient was taken to theatre for removal of the object under general anesthesia via an extra-oral approach, consent having been obtained from the patient for both the procedure and the use of the clinical material for academic purposes.

## DISCUSSION

Impalement of the orbit by a foreign body is a rare phenomenon. A prevalence of 0,29% was reported in Nigeria.<sup>4</sup> The foreign bodies that have been involved in cranio-facial impaction may be classified according to their composition as metallic, such as steel; non-metallic, which may be organic, such as wood and vegetable matter and inorganic, such as glass.<sup>2</sup>

Prompt detection and accurate localization of IOFBs is essential for the optimum management of patients, enabling the surgeon to plan the most atraumatic method of removing the intruder. Unfortunately, the nature and extent of the injury in this case was not diagnosed on initial presentation, perhaps associated with there being only a minor laceration on the lower eyelid and oedema. Other factors that must have contributed would be an assessment that focused on the globe and the failure to take plain radiographs.

Clinical management of foreign bodies is dependent on their composition and the site of impalement. Intraocular foreign bodies are usually removed surgically to prevent complications from chemical reactions (e.g., siderosis from iron) or infection. Extraocular foreign bodies are managed conservatively, and therefore, it is important to accurately differentiate between intraocular and extraocular locations. Retained foreign bodies may give rise to cellulitis, abscess, fistulas, and impaired vision and motility.<sup>1</sup>

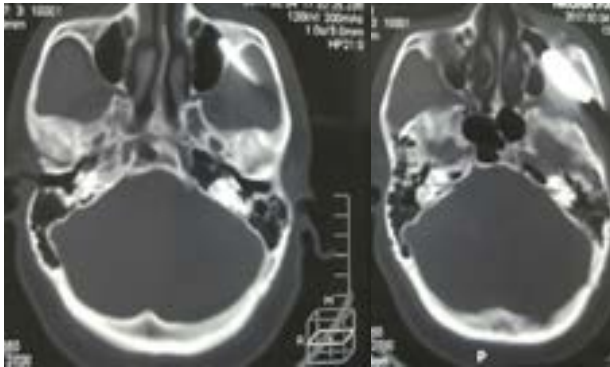
Diagnostic imaging modalities are critical in the diagnosis, confirmation and localization of IOFBs.<sup>5</sup> Plain radiographs are inexpensive and readily available, but radiolucent material, such as graphite, plastic, and fresh or dry wood may be underestimated.<sup>1,3</sup> In this patient the presence of a foreign body was diagnosed with routine radiology.

The clinical sign of restricted mouth opening could not be explained based on that diagnostic imaging, and hence the CT scan was requested in order to determine the posterior extent of the injury.

Ocular ultra-sonic scanning offers a higher sensitivity than plain radiographs for detecting all kinds of IOFBs and is accurate for intraocular foreign bodies. However, it is time consuming, operator dependent, and may be technically difficult in an open globe.<sup>1</sup>

Computed tomography is very useful in the determination of the size of foreign bodies and in localizing them as intraocular, extraocular, or retro-ocular. CT is generally considered the gold standard in the evaluation of IOFBs because it is safe to use with metallic IOFBs and is also able to diagnose orbital wall fractures and orbital sepsis with high accuracy.<sup>1,2</sup>

CT is accurate at detecting and localizing intraorbital metallic, glass, and stone foreign bodies.<sup>1</sup> In this case, CT scans were able to show that the foreign body was protruding into the infratemporal space, suggesting that there may have been a form of injury to the temporalis muscle. That would explain the restricted mouth opening associated with the intraorbital foreign body in this patient.



**Figure 4.** Axial views of the CT-Scan indicating door handle extending into the infra-temporal region.

A local anesthetic with a vasoconstrictor was injected in the area of the laceration prior to making an incision through the infraorbital scar, extending about 1cm. A careful dissection through the soft tissue layers was made, avoiding the application of any forces which may have displaced the object.

The tip of the door handle was encountered after dissection through the subcutaneous layer. The object was clamped with Crile forceps and gently removed, reversing along the path of penetration, which was judiciously followed to prevent further injuries (Figs 5 and 6)).

The area was thoroughly assessed for any fractures, and none were noted. The wound was debrided and irrigated with normal saline. The wound was sutured in layers with 3.0 vicryl rapid and 5.0 nylon for the skin.



**Figure 5 and 6.** Door handle being removed through the lower eyelid incision; the tip of the door handle after being removed

On review after a week the patient was asymptomatic, eye function was normal and could open the mouth wide, with an interincisal distance of 45mm. The nylon suture was removed and the patient was discharged.

Magnetic Resonance Imaging (MRI) examination is of value when there is a high suspicion of IOFBs, especially wooden IOFBs with a negative CT scan. However, failure to detect a metallic foreign body before MRI may result in globe perforation and blindness should the object move in response to magnetic forces during imaging.<sup>1</sup>

Indication for removal may include a superficial location, protrusion through the skin,<sup>6</sup> large size, interference with ocular function, infection, persistent inflammation, and communication with intracranial cavity and or paranasal sinuses.<sup>1</sup>

## CONCLUSION

Trauma officers should always harbour a high index of suspicion for impacted foreign bodies until their presence is otherwise excluded by plain radiography. Also, non-resolving abscess around the scars of previous injury, in the face of clear plain x-rays, should be an indication for advanced diagnostic imaging.

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# What's new for the clinician – excerpts from and summaries of recently published papers

SADJ February 2019, Vol. 74 No. 1 p35 - p38

Compiled and edited by Prof V Yengopal, Dept. of Community Dentistry, School of Oral Health Sciences, Faculty of Health Sciences, University of the Witwatersrand

## 1. Is there a correlation between oral hygiene status and oral HPV infection in adults?

D Dalla Torre, D Burtscher, E Sölder, et al. Clin Oral Invest. 2019; 23: 179-85.

Oral human papillomavirus (HPV) infections affect some seven percent of adults in the U.S. and is responsible for a growing number of oral cancer cases, especially in men.<sup>1</sup>

The causal role of vaginal high-risk HPV infections in cervical cancer has been proven already decades ago, and more recent studies have shown a positive correlation between oral HPV and certain subtypes of oropharyngeal cancer.<sup>1</sup> Various risk factors have been associated with oral HPV infections, especially regarding sexual behaviour and promiscuity. However, there is still a lack of knowledge regarding additional factors that may facilitate the oral infection of HPV.

Dalla Torre and colleagues (2019)<sup>1</sup> reported on a study that sought to investigate the possible relationship between objectively determined oral hygiene, with the Approximal Plaque Index (API) and the Gingival Bleeding Index (GBI) as marker, and oral HPV infections. Additionally, a possible correlation between general oral health, with tooth loss as indicator, and oral HPV infections was also investigated.

### MATERIALS AND METHODS

This is a prospective cross-sectional study involving 187 patients. Patients were considered for inclusion if they met the following criteria: 18–50 years of age; absence of any oral cancer in the past or present; no history of HPV vaccination; provided informed consent; completed questionnaire and measurement of the approximal plaque index (API). Patients were excluded, if: the study questionnaire or measurements regarding oral hygiene indices were incomplete or missing and/or the patient refused the brush smear sample collection. During the clinical oral examination, an assessment of the number of already extracted teeth (except wisdom teeth), API and the gingival bleeding index (GBI) was completed.

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### ACRONYMS

<b>API:</b>	Approximal Plaque Index
<b>GBI:</b>	Gingival Bleeding Index
<b>HPV:</b>	Human Papillomavirus
<b>OR:</b>	Odds Ratio

The API was calculated using the formula:

$$\text{API} = \frac{\text{number of plaque sites}}{\text{number of sites examined}} \times 100.$$

Depending on their API scores, the patients were subdivided into three groups:

- API < 20%, representing the group with good oral hygiene.
- API = 20–40%, representing the group with a fair, although improvable result.
- API > 40%, representing the group with poor oral hygiene.

The GBI was used as marker for the quality of oral hygiene in regard of gingival health. Thereby, The number of bleeding sites was recorded about 10 seconds after gentle probing of the gingival sulcus of all teeth in six different anatomical sites (mesiobuccal, buccal, distobuccal, mesiolingual, lingual, distolingual).

The proportion of bleeding sites was expressed as a percentage of all examined sites. According to the GBI scores, the study population was divided into three groups: GBI < 20%, representing the group with good oral hygiene; GBI = 20–40%, representing the group with a fair, although improvable result; and GBI > 40%, representing the group with poor oral hygiene.

Within a few days after the first professional oral hygiene, two brush smears from the left and the right buccal mucosa were taken by the investigators. After specimen collection, HPV detection was placed into three categories: “no infection,” “low risk HPV-infection,” and “high risk HPV-infection.”



## RESULTS

The study involved 187 patients, 91 (48.7%) females and 96 (51.3%) males. Overall, the mean age was 28.5 (range 23–46 years, SD 5.7) years, whereas the mean age in the female group was 29.4 (range 24–46 years, SD 6.8) years and in the male group 27.9 (range 23–45 years, SD 4.5) years.

Ninety-three (48.7%) of the patients showed a full dentition, 62 (34.2%) study participants had experienced one to three extractions of permanent teeth in their lifetime, and 32 (17.1%) patients had lost more than three teeth.

A positive HPV testing was found in 39 (20.9%) cases, whereas the brush smear testing was negative in 148 (79.1%) patients. In 27 (14.4%) cases, the presence of high-risk HPV was diagnosed, and in 26 (13.9%) cases, low-risk HPV. In 14 (7.5%) cases with a positive HPV testing, the combined presence of low-risk and high-risk HPV was discovered.

The first group with an API < 20% consisted of 74 (39.6%) patients, the second group with an API = 20–40% included 84 (44.9%) patients, and the last group with an API > 40% comprised 29 (15.5%) patients.

Regarding the association between the API and a positive oral HPV detection (regardless of low- or high-risk HPV), the presence of oral HPV was significantly correlated with high API. For patients with an API of 20 to 40%, an odds ratio (OR) of 2.80 (95% CI 1.10 to 7.10,  $p=0.0304$ ) was determined, whereas the OR increased to 7.78 (95% CI 2.67 to 22.64,  $p=0.0002$ ) in cases with an API of more than 40%.

Results regarding GBI were similar with an OR of 3.01 (95% CI 1.34 to 6.72,  $p=0.0074$ ) in cases with a GBI of 20 to 40% and an OR of 6.01 (95% CI 1.86 to 19.37,  $p=0.0027$ ) for a GBI > 40%. Concerning lifetime tooth loss, there was a highly significant relation to oral HPV infections for people having lost one to three teeth (OR 2.98, 95% CI 1.21 to 7.33,  $p=0.0175$ ) and those who had lost more than three teeth (OR 8.24, 95% CI 3.10 to 21.88,  $p<0.0001$ ). Regarding gender, no statistically significant correlation with the presence of oral HPV was detected ( $p=0.994$ ).

If only low-risk HPV positivity was considered, no statistically significant association could be recorded regarding an API of < 40% (OR 2.64, 95% CI 0.80 to 8.67,  $p=0.1104$ ). In contrast, an API > 40% was significantly associated with the presence of oral low-risk HPV with an OR of 10.69 (95% CI 3.05 to 37.56,  $p=0.0002$ ). Regarding the GBI measurement, there were significant differences recorded, with an OR of 2.67 (95% CI 1.01 to 7.06,  $p=0.0486$ ) for a GBI of 20 to 40% and an OR of 7.63 (95% CI 2.14 to 27.20,  $p=0.0017$ ) for patients with a GBI > 40%. A significant relation to oral low-risk HPV was determined also for the number of lost teeth, with an OR of 3.80 (95% CI 1.25 to 11.54,  $p=0.0187$ ) for patients with one to three missing teeth and an OR of 8.00 (95% CI 2.48 to 25.80,  $p=0.0005$ ) for more than three missing teeth. Again, there was no significant relationship regarding gender ( $p=0.7827$ ).

If only oral high-risk HPV infections were analyzed, a statistically significant association between a positive testing and the API could be seen (API 20–40%: OR 3.50, 95% CI 1.10 to 11.16,  $p=0.0342$  versus API > 40%: OR 7.88, 95% CI 2.19 to 28.28,  $p=0.0016$ ). A significant result was determined also regarding GBI (GBI 20–40%: OR 3.75, 95% CI 1.38 to 10.21,  $p=0.0097$  versus GBI > 40%: OR 9.00, 95% CI 2.44 to 33.24,  $p=0.0010$ ) and the lifetime number of extracted teeth with an OR of 4.22 (95% CI 1.41 to 12.68,  $p=0.0102$ ) for one to three extracted teeth and an OR of 8.00 (95% CI 2.48 to 25.80,  $p=0.0005$ ) in case of more than three lost teeth. Regarding patients' gender, no significant differences were detected involving gender ( $p=0.9538$ ).

Regarding patients' age, there were no significant results regarding a relation to any oral HPV detection or to the API. Older patients had experienced more extractions than younger patients ( $p<0.0001$ ). Data regarding the correlation between oral HPV infection and API, GBI and the number of lost teeth were adjusted for age and gender, achieving similar results compared with the unadjusted analysis.

## CONCLUSION

The present analysis confirmed a relationship between the quality of oral hygiene, as determined by objective markers, and the presence of oral HPV.

### Implications for practice

The findings of this study confirm the benefits of improving oral hygiene to reduce the risk of Oral HPV infection and/or oral cancer in the mouth.

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## 2. Routine scale and polish for periodontal health in adults: a Cochrane systematic review

T Lamont, HV Worthington, JE Clarkson, PV Beirne. 2018, Issue 12. Art. No: CD004625. DOI: 10.1002/14651858.CD004625.pub5

Scaling and polishing of the teeth by a dentist or a dental care professional (DCP) (dental therapist or dental hygienist), also known as prophylaxis, professional mechanical plaque removal or periodontal instrumentation, is a non-surgical intervention that is intended to supplement (and is not a substitute for) the patient's home-care plaque control.<sup>1</sup> This treatment is frequently provided as part of the dental recall appointment.

Scaling and polishing is also often undertaken for patients irrespective of their risk of developing periodontal disease. There is ongoing debate over the clinical effectiveness and cost effectiveness of routine scaling and polishing of teeth and how often it should be provided. This debate is complicated by the fact that a 'routine S&P' is not a precisely defined intervention in periodontal disease management and there is no universally accepted definition of the term. In the USA, the term 'oral prophylaxis' is most often used and has been defined as "the removal of plaque, calculus and stain from exposed and unexposed surfaces of the teeth by scaling and polishing as a preventive measure for the control of local irritational factors".<sup>1</sup>

Lamont and colleagues (2018)<sup>1</sup> undertook a Cochrane Systematic review with the following objectives:

- To determine the beneficial and harmful effects of routine scaling and polishing for periodontal health.
- To determine the beneficial and harmful effects of routine scaling and polishing at different recall intervals for periodontal health.
- To determine the beneficial and harmful effects of routine scaling and polishing for periodontal health when the treatment is provided by dentists compared with dental care professionals (dental therapists or dental hygienists).

### SEARCH METHODS

Cochrane Oral Health's Information Specialist searched the following databases: Cochrane Oral Health's Trials Register (to 10 January 2018), the Cochrane Central Register of Controlled Trials (CENTRAL) (the Cochrane Library, 2017, Issue 12), MEDLINE Ovid (1946 to 10 January 2018), and Embase Ovid (1980 to 10 January 2018). The US National Institutes of Health Trials Registry (ClinicalTrials.gov) and the World Health Organization International Clinical Trials Registry Platform were searched for ongoing trials. No restrictions were placed on the language or date of publication when searching the electronic databases.

### SELECTION CRITERIA

Randomised controlled trials of routine scale and polish treatments, with or without oral hygiene instruction, in healthy dentate adults without severe periodontitis. Split-mouth trials were excluded.

### ACRONYMS

<b>BPE:</b>	Basic Periodontal Examination
<b>CIs:</b>	95% Confidence Intervals
<b>DCP:</b>	Dental Care Professional
<b>MDs:</b>	Mean Differences
<b>RR:</b>	Risk Ratios
<b>SMDs:</b>	Standardised Mean Differences

### DATA COLLECTION AND ANALYSIS

Two review authors screened the results of the searches against inclusion criteria, extracted data and assessed risk of bias independently and in duplicate. They calculated mean differences (MDs) (or standardised mean differences (SMDs) when different scales were reported) and 95% confidence intervals (CIs) for continuous data and risk ratios (RR) and 95% CIs for dichotomous data. A fixed-effect model was used for meta-analyses. Study authors were contacted when necessary to obtain missing information. The certainty of the evidence was rated using the GRADE approach.

### RESULTS

Of the 1002 records assessed in the literature search, two trials were included for meta-analysis in this review. Both trials were conducted in the United Kingdom (UK). Ramsay 2018 included 1406 participants and Jones 2011 included 305 participants in the analyses, giving a total of 1711 participants in this review. Participants were adults aged 18 to 92 years in Ramsay 2018<sup>1</sup> and aged 18 to 73 years in Jones 2011.<sup>1</sup>

Ramsay enrolled people with Basic Periodontal Examination (BPE) scores of three or less, attending general dental practices across Scotland and the North-East of England. Jones enrolled people attending one of three general dental practices for check-up appointments. This study included only those patients with calculus or bleeding on probing and no pockets greater than 3.5 mm.<sup>1</sup>

#### Comparison 1: routine scaling and polishing versus no scheduled scaling and polishing

Two studies compared planned, regular interval (six- and 12-monthly) scale and polish treatments versus no scheduled treatment. Little or no difference was found between groups over a two- to three-year period for gingivitis, probing depths, oral health-related quality of life (all high-certainty evidence) and plaque (low-certainty evidence).

The SMD for gingivitis when comparing six-monthly scale and polish treatment versus no scheduled treatment was  $-0.01$  (95% CI  $-0.13$  to  $0.11$ ; two trials, 1087 participants), and for 12-monthly scale and polish versus no scheduled treatment was  $-0.04$  (95% CI  $-0.16$  to  $0.08$ ; two trials, 1091 participants).

Regular planned scale and polish treatments produced a small reduction in calculus levels over two to three years when compared with no scheduled scale and polish treatments (high-certainty evidence). The SMD for six-monthly scale and polish versus no scheduled treatment was  $-0.32$  (95% CI  $-0.44$  to  $-0.20$ ; two trials, 1088 participants) and for 12-monthly scale and polish versus no scheduled treatment was  $-0.19$  (95% CI  $-0.31$  to  $-0.07$ ; two trials, 1088 participants). The clinical importance of these small reductions is unclear.

Participants' self-reported levels of oral cleanliness were higher when receiving six- and 12-monthly scale and polish treatments compared with no scheduled treatment, but the certainty of the evidence is low.

#### Comparison 2: routine scaling and polishing at different recall intervals

Two studies compared routine six-monthly scale and polish treatments versus 12-monthly treatments. Little or no difference was seen between groups over two to three years for the outcomes of gingivitis, probing depths, oral health-related quality of life (all high-certainty evidence) and plaque (low-certainty evidence).

The SMD for gingivitis was  $0.03$  (95% CI  $-0.09$  to  $0.15$ ; two trials, 1090 participants;  $I^2 = 0\%$ ). Six-monthly scale and polish treatments produced a small reduction in calculus levels over a two- to three-year period when compared with 12-monthly treatments (SMD  $-0.13$  (95% CI  $-0.25$  to  $-0.01$ ; two trials, 1086 participants; high-certainty evidence). The clinical importance of this small reduction is unclear.

The comparative effects of six- and 12-monthly scale and polish treatments on patients' self-reported levels of oral cleanliness were uncertain (very low-certainty evidence).

#### Comparison 3: routine scaling and polishing provided by dentists compared with dental care professionals (dental therapists or hygienists)

No studies evaluated this comparison.

The review findings in relation to costs were uncertain (very low-certainty evidence).

## CONCLUSIONS

For adults without severe periodontitis accessing routine dental care, there is little or no difference in gingivitis, probing depths or quality of life over two to three years between routinely provided six-monthly scale and polish (S&P) treatments, 12-monthly S&P treatments and no scheduled S&P treatments (high-certainty evidence). There may also be little or no difference in plaque levels over two years (low-certainty evidence).

Although routine S&P treatments produced a small reduction in calculus levels over two to three years when compared with no scheduled S&P treatments, the six-monthly treatments reducing calculus more than 12-monthly treatments (high-certainty evidence), the importance of these reductions for patients and clinicians is unclear. The studies did not assess the adverse effects of S&P treatments and available evidence on the costs of the treatments is uncertain.

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1. Lamont T, Worthington HV, Clarkson JE, Beirne PV. Routine scale and polish for periodontal health in adults. Cochrane Database of Systematic Reviews 2018, Issue 12. Art. No: CD004625. DOI: 10.1002/14651858.CD004625.pub5.

## Do the CPD questionnaire on page 44



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# Non-maleficence – a disremembered moral obligation

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PD Motloba<sup>1</sup>

## THE CASE

Mr Mishak Molefe is a 35-year-old dental therapist and a minority shareholder in a group practice (Magnificent), located in the Sandton area. Since joining the practice over 10 years ago, Mishak has displayed excellent clinical, technical and professional skills. Over the past few months, you have noticed a significant deterioration in his personality, work ethic and clinical performance. Mishak started missing work, usually on Mondays; he was not keeping patient appointments, resulting in many complaints against him. Among the grievances were two notices from the Health Professions Council of South Africa (HPCSA) indicating (i) non-compliance with his Continuous Professional Development (CPD) requirements for past three years, (ii) abandonment of a patient following an unsuccessful removal of an impacted 38. An investigation by the partners found that Mishak was on antidepressants and was abusing alcohol and other substances. Eventually, Mishak and other shareholders reached an agreement that his services in the group practice were to be terminated.

## INTRODUCTION

Moral and ethical values of health professionals come under intense scrutiny. Justly, the conduct of health professionals in recent times has merited rigorous and intense appraisal and resultant disapproval, especially in the wake of atrocities such as South African Life Healthcare Esidimeni.<sup>1</sup> Central to this criticism is the apparent abdication by most professionals of the most fundamental professional undertaking, namely to abstain from harming patients. Anecdotal evidence indicates wilful disregard by some clinicians when treating patients, especially those who are most vulnerable, including the young, the elderly and mentally challenged patients. This spate of such patients suffering maltreatment at the hands of practitioners suggests that clinicians may be oblivious to the obligation not to cause harm, or may lack the conceptual understanding of what harm means, or how it should be minimised in the clinical setting.

Notwithstanding substantial methodological challenges to the understanding of harm, this paper aims to provide a conceptual discussion of non-maleficence and

its application and implication in the dental practice. Further elucidation will be provided on how and where harm and injury is likely to occur in dentistry.

## DEFINITION OF HARM

The understanding of non-maleficence is rooted in the moral intent of an agent to abstain from harming or imposing risk of harm or to prevent injuries to others. The concept of harm is broad and is highly contested in literature.<sup>2-5</sup> The plethora of definitions of harm encapsulate “trivial” notions of harm such as to annoy, humiliate, offend, and or cause discomfort.<sup>2,5,6</sup> More serious views of harm include interfering with one’s liberties, privacy, reputation, property etcetera.<sup>2,5,6</sup> Despite these contestations, it is generally accepted that harm implies that one has been injured, violated, or treated unjustly by another. Beauchamp and Childress conceptualise harm as the “thwarting, defeating, or setting back of some party’s interest.”<sup>4</sup> However, harming another person is not tantamount to wrongdoing; that is some harmful activities may be justifiable. Therefore, causing harm does not necessarily mean a party has been wronged, rather, their particular interests may be superseded at a given point in time. Similarly, having being wronged does not equate to being harmed. For example, a resection of a malignant mandibular tumour is clinically justifiable, and in this instance a patient may be *harmed* but not *wronged*. The dismissal of a negligent clinician is not wrong, though harmful, as his interests, financial security and reputation would be thwarted. Therefore, for health professionals, it can be argued that non-maleficence has been entrenched as a *prima facie* principle that requires the justification of harmful actions.<sup>5</sup>

Simply put, a clinician’s harmful actions may not be deemed morally or legally wrong provided they are aligned with specific rules of non-maleficence or are not superseded by other moral principles. Causing some harm in order to benefit the patient may be desirable, necessary and justifiable. Clinicians often face serious moral and ethical dilemmas in which they have to determine whether the harm they may cause is justified in terms of any associated possible benefits to the patient. According to the Catholic doctrine of the rule of “double effects”,<sup>7</sup> clinicians are obligated to consider jointly the principles of beneficence and non-maleficence when making clinical decisions.<sup>7</sup> It is therefore incumbent on clinicians to assess the risks or the occurrence of inadvertent and yet predictable untoward effects of a prescribed intervention. Additionally, the clinician must assess the benefits of the intervention primarily to the patient, before considering other parties

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such as family and society. Armed with these facts, it is obligatory for clinicians to balance anticipated benefits against risks and harm as evaluated by patients, society and normatively by clinicians. Without this information the patients may be placed in harm's way.

Frankena<sup>6</sup> provides the most articulate amalgamation of the principles of beneficence and non-maleficence as follows:

- One ought not to inflict evil or harm
- One ought to prevent evil or harm
- One ought to remove evil or harm
- One ought to do or promote good.

Frankena's exposition of non-maleficence as expressed in the first rule of non-maleficence corresponds with the maxim *primum non nocere*.<sup>6</sup> The remaining three rules comply with the principle of beneficence. Based on the hierarchy of these moral guidelines, the obligation not to do harm is more stringent and takes *prima facie* precedence over the obligation for beneficence. However and as argued by Gillion et al.,<sup>8</sup> the notion "...above all do no harm" is impractical, unattainable and unjustifiable within the clinical context. Accordingly, when resolving moral dilemmas, the principle of non-maleficence cannot supersede, but should instead be considered in tandem with obligations of beneficence, autonomy and justice.<sup>9</sup>

We restrict, in this article, the notion of non-maleficence to physical and psychological harm. Furthermore and included are the associated outcomes such as pain, handicap, disability, suffering, loss or death. For oral health professionals, the notion of non-maleficence includes prevention, avoidance and removal of harm or mitigation of the risk of harm to dental patients. Dental patients may experience harm or increased risk of injury due to commission or omission or because of a deliberate or unintentional action by an attending professional or their staff within the clinical setting.

## CONTEXT OF HARM IN CLINICAL PRACTICE

Non-maleficence includes the obligation not to cause harm or to inflict the risk of harm. This undertaking is implicitly espoused in the Hippocratic Oath and pledges undertaken by health professionals to honour the inviolability of the patient. The obligation of clinicians to non-maleficence in caring for patients, assumes the commitment to exercise "due care".<sup>10</sup> A "reasonable clinician" has a duty to act (i) sufficiently carefully; (ii) act lawfully and (iii) loyally, by providing appropriate care with the least amount of harm.<sup>11</sup> Duty of care is a negligence concept, which implies that a clinician would be negligent if he fails to use due care under specific circumstances.<sup>12</sup>

Underpinned by the principle of non-maleficence, dentists ought to maintain the highest level of conduct and competence commensurate with their professional norms and standards. It is foremost critical for dental education to meet stringent standards and quality that would enable dental professionals to manage dental patients satisfactorily. This quality assurance mandate is effected by training institutions, with the oversight of the regulator (HPCSA). The need for quality education extends

beyond formal university learning to include acquisition of CPDs (Continuing Professional Development). This form of lifelong learning is meant to sustain the desired levels of clinical, cognitive and affective competencies. These skills are critical in this era of rapid technological revolution and increased demands by patients alike. It is hence morally indefensible for dental practitioners to fail to adopt beneficial health care developments, more so if the developments seek to reduce harm but continue to benefit patients. Understandably, health-governing bodies (such as the HPCSA) introduced a compulsory CPD programme as a requisite for practitioners to maintain their registration and licence to continue to practice their trade. This practice is part of the legal obligation of the regulator and moral obligation by the clinician to ensure beneficence and non-maleficence towards the patient.

The principle of non-maleficence obliges dentists to safeguard the welfare of patients by procuring the special skills of colleagues with advanced knowledge and competencies. It is hence imperative for practitioners to understand their limits in terms of knowledge and clinical skills and to refer appropriately. Failure to refer patients when it is necessary could result in serious harm to the patients. Referrals between the dentist and specialist should be undertaken in a collegial manner in order to avoid further harm to the patient and to professionals. Similarly, when a patient is referred for second opinion, such opinions should be provided in accordance to professional norms and codes of conduct. Dental professionals must guard against touting and supersession in such instances. In group practices, the dentists in charge are ultimately responsible for the care provided by the auxiliary staff in their employ. The principal clinician is obliged to prescribe, oversee and assure that the desired quality of care provided is by these personnel, and that no harm or injury occurs.

Dental practitioners who are impaired in some way or are unable to practice to full extent, should limit their practice to levels commensurate with their current skills and competence. Failure to recognise these clinical limitations could harm or increase the risk of harm to the patients. The impairment could be permanent due to disease, or intermittent due to the abuse of substances. In all these cases, it is also obligatory for colleagues to report such concerns to authorities to protect patients and in support of the practitioners. Dentists exposed to infectious conditions should inform patients about that status and seek consent for treatment, according to acceptable clinical protocols. Intra-operatively the dentist may not terminate the treatment without informing the patients appropriately. It is proper professional conduct to allow the patient ample time to find care from another professional. When another dentist provides such care, no case of supersession can be lodged. Ultimately, the patient has absolute right to decide who their practitioner should be.

## EVALUATING MR MISHAK'S CASE

By not acting or failing to act as expected, Mishak and Magnificent Dental placed the patients at risk of harm. This level of commission and omission contravenes the obligation of non-maleficence as espoused in the

Hippocratic Oath (and other ethical rules – HPCSA). Jointly, Mishak and Magnificent Dental failed to appreciate and manage the factors that caused or increased the risk of harm to the patients.

First, the failure to comply with CPD requirements meant that Mishak did not stay up to date with current developments in clinical care. Consequently, he may not have been able to provide the best available patient care and improved clinical outcomes. Therefore, Mishak's conduct increased the risk of harm, and minimised possible benefits.

Secondly, by missing appointments of patients, Mishak delayed the provision of needed and or scheduled dental care. As a result the prognosis worsened, resulting in unhealthier and unhappier patients. Third, the organization abdicated its responsibility of ensuring that all employees are healthy, physically, mentally and psychologically, thereby increasing the risk of harm to patients by clinicians such as Mishak.

The Table below provides a synopsis of actions, inactions, and related ethical principles and moral rules that have been violated or disregarded.

## CONCLUSION

This case highlighted the nuances of non-maleficence, including the failure by clinicians to recognise the intricacies of their conduct as possible causes of harm to patient. As discussed in this article, any form of omission or abdication of professional rules, renunciation of moral rules, and disregard of codes of practice, is tantamount to a commission of maleficence. Similarly, failure to act

according to the scope of practice, or to discharge clinical responsibilities with necessary care is maleficent.

At the very least practitioners should remember the maxim *primum non nocere* or at the very least do no harm. This might be challenging as most clinicians have a limited understanding of the concept of harm.

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Category	Action	Violated moral and ethical codes	
		<b>Moral codes*</b>	<b>HPCSA Booklet 2 regulation**</b>
Clinical (diagnosis, treatment, etcetera)	Poor diagnosis (failure to determine the clinical needs of the patient)	B + C	(s27A)(a)
	Improper treatment – removal of impacted 38	B + C	(s27A)(Ann1)(1)(e)
	Failure to refer to appropriate practitioner	B + C	(s27A)(Ann1)(d)
Professional	Practised beyond the scope (undertaking treatment beyond one's expertise)	A + B + C + D	(s27A)(Ann1)(1)(a)
	Failure to honour appointments	A + B + C + D	(s27A)(a)
	Substance abuse	A + B + C + D	(s25)(1)(b)
	Outstanding CPDs	A + B + C + D	(s27A)(e)
Organizational stewardship	Failure to recognise handicap of employee. Or of colleague	A + B + C + D	(s25)(1)(a)(c)
	Failure to refer, report colleague to relevant authorities and effect rescue	A + B + C + D	(s25)(1)(a)(b)(c)

### \*Moral Codes:

A - Autonomy;

B - Beneficence;

C - Consequentialism: the consequences of one's conduct are the ultimate basis for any judgement on the rightness or wrongness of that conduct.

D - Deontology: the science of duty or moral obligation (Shorter Oxford English Dictionary)

\*\*HPCSA booklet 2 (H2)

# Maxillofacial Radiology 167

SADJ February 2019, Vol. 74 No. 1 p43

CJ Nortjé

Below are two cases of a tumour rather commonly found in other bones of the body but rarely seen in the jaws. When it occurs in the maxillofacial region it is most frequently in the 50-60 year-old age group. What are the important radiological features and what is your diagnosis?



Fig. 1



Fig. 2



Fig. 3



Fig. 4

## INTERPRETATION

Figure 1 shows an expansive lesion with well-defined borders. Figures 2 & 3 are coronal and axial CT images of the same lesion showing irregular calcifications (arrows) within the radiolucency, histologically diagnosed as a chondroma, a benign tumour of cartilage without any bone formation. On occasion, the chondroma may become partially ossified and is then more appropriately called an osteochondroma (see MFR case 113), a slow growing, locally invasive, tumour of bone and cartilage. There is some laxity in the use of the terms as well as some difficulty in separating a partially ossified chondroma from the osteochondroma. Malignant forms of chondroma are termed chondrosarcoma. There are two types of chondroma. The *central chondroma* arises deep in the bone (Figures 1, 2 & 3), expanding the cortical plates. It is probably more common than the *periosteal chondroma*, which develops on the surface. Radiologically, the periosteal type may show an irregular, variably radiopaque, and radiolucent mottled lesion protruding from the cortex (Figure 4) as a raised radiolucent mass in which there are scattered and irregular areas of calcification.

Beneath is a saucer-shaped concavity of the alveolar ridge, probably produced by pressure erosion. The base of the concavity is sclerotic, which suggests the benign nature of the lesion. Due to the paucity of published cases no definite features of the periosteal chondroma are presently available. Although the chondroma is a rather common type of bone tumour it is rarely found in the jaws. In the mandible the posterior part, especially the coronoid and condylar processes are areas of predilection. The anterior part of the maxilla is the site of nearly all the chondromas affecting the upper jaw, where they tend to extend into the nose and paranasal sinuses. When the condyle is affected, an early symptom may be a slight discomfort in the joint region followed by a progressive deviation of the jaw to the unaffected side and eventually restrictions in jaw movements. Resection is usually the preferred treatment because of the aggressive nature and tendency of the tumour to recur. Radiopacities present in the maxillary sinuses on the coronal and axial CT images are suggestive of mucus retention cysts.

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Stafne EC & Gibilisco JA: Oral Roentgenographic Diagnosis, 4<sup>th</sup> Ed, W.B Saunders. Philadelphia 1975 pp 196-197.



# CPD questionnaire

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

## GENERAL

### Comparison of the effect of fixed and variable taper on the volume of obturation material

1. Identify the CORRECT statement. The single file concept in endodontics evolved as a result of:
  - A. improved metallurgy
  - B. development of the tapered instrument
  - C. development of the reciprocating file technique
  - D. improvement of the cutting performance
2. Identify the INCORRECT statement. MicroComputed Tomography ( $\mu$ CT) is considered a superior method for assessing the sealing ability of obturation materials because:
  - A. it is non destructive
  - B. it allows for the escape of some material
  - C. it is non invasive
  - D. it presents a 3-D visualisation
3. Identify the CORRECT statement. In this study the percentage of canals having a 100% seal were:
  - A. 93%
  - B. 0%
  - C. 25%
  - D. 30%
4. Identify the INCORRECT statement. Extrusion of gutta percha beyond the apex has been shown to be associated with:
  - A. thermoplastisized GP more than with cold lateral obturation
  - B. fixed taper canal preparation
  - C. rate of insertion of GP
  - D. incomplete glide path preparation

### Research misconduct and publication ethics: a South African perspective

5. Identify the INCORRECT statement. According to the International Committee of Medical Journal Editors, an individual qualifies for authorship only if he/she satisfies the following criteria:
  - A. Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work
  - B. Drafting the work or revising it critically for important intellectual content
  - C. Final approval of the version to be published
  - D. Has personally completed the statistical analyses
  - E. Agrees to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved
6. Tangible conflicts of interests include, among others: conflicts of interest at an individual level; intellectual bias and conflicts of conscience.
  - A. True
  - B. False
7. Identify the INCORRECT statement. During the Peer Review process the following factors should be considered when manuscripts are reviewed:
  - A. Appropriate statistical analysis
  - B. At least thirty references
  - C. The importance and novelty of the science
  - D. The appropriateness of the research design
  - E. The quality and validity of the data
8. Identify the INCORRECT statement. Self-Plagiarism constitutes:
  - A. Submitting to another journal a manuscript for publication that has previously been disseminated
  - B. Accepting the credit for a paper which is republished in another journal with the permission of the editor of the original journal
  - C. Reusing your own previously-published text verbatim, without appropriate use of quotation marks and referencing
  - D. Submitting a research report in order to fulfil a course or degree requirement, even though that work had been submitted previously to satisfy the requirements for another programme at a different university or academic institution

### Oral health status among Nyaope users at drug rehabilitation clinics in Johannesburg

9. Identify the INCORRECT statement. Nyaope is considered a dangerous addictive drug because:
  - A. it has effects on multiple bodily systems
  - B. users experience considerable problems when trying to stop the habit
  - C. a minimum of a year of comprehensive care is required for successful rehabilitation
  - D. it is easily available and is relatively cheap
  - E. it has a pleasant taste
10. Identify the INCORRECT statement. Compared with non-drug users, Nyoape addicts had:
  - A. significantly higher cariogenic diets
  - B. significantly higher caries prevalence
  - C. significantly higher DMFT scores
  - D. nevertheless, significantly higher daily oral hygiene practices

11. Identify the INCORRECT statement. Smoking reduces bleeding on probing through:
- enhanced clotting activity
  - vasoconstriction of the gingival blood vessels
  - blunting of the inflammatory cascade normally seen in response to bacterial invasion
  - limited blood flow to gingiva

### Clinical windows

#### Is there a correlation between oral hygiene status and oral HPV infection in adults?

12. The presence of oral Human Papillomavirus (HPV) was significantly correlated with high API, regardless of low- or high-risk HPV.
- True
  - False
13. Recent studies have shown a positive correlation between oral HPV and certain subtypes of oropharyngeal cancer.
- True
  - False
14. The findings of this study confirm the benefits of improving oral hygiene to reduce the risk of Oral HPV infection and/or oral cancer in the mouth.
- True
  - False

#### Routine scale and polish for periodontal health in adults: a Cochrane systematic review

15. The study showed that there is little or no difference in gingivitis, probing depths or quality of life over two to three years between routinely provided six-monthly scale and polish (S&P) treatments, 12-monthly S&P treatments and no scheduled S&P treatments (high-certainty evidence) in patients without severe periodontitis.
- True
  - False
16. Considered for inclusion in this study were 1002 papers of which two were finally accepted for the meta analysis.
- True
  - False

#### Unusual intra-orbital foreign body impactions, a case report

17. Plain radiographs are sufficient in determining the extent of ocular injury and the location of the foreign bodies.
- True
  - False
18. The following are/is the possible complication(s) of untreated intra-ocular foreign body impalements:
- Fistula
  - Impaired vision
  - Impaired eye movements
  - Abscess
  - All of the above

### Maxillofacial and oral radiology

19. Chondromas are exceedingly common in the jaws.
- True
  - False
20. Chondroma is a benign tumour composed of cartilage.
- True
  - False

### ETHICS

21. The moral and Ethical codes on which the HPCSA bases ethical philosophy include:
- Autonomy
  - Beneficence
  - Consequentialism: the consequences of one's conduct are the ultimate basis for any judgement on the rightness or wrongness of that conduct
  - Deontology: the science of duty or moral obligation
  - Poor treatment planning
22. A practitioner who undertakes treatment beyond his/her scope of expertise violates the following codes:
- Autonomy, Beneficence, Deontology
  - Autonomy, Beneficence, Consequentialism, Deontology
  - Deontology, Beneficence, poor treatment planning
  - Autonomy, Consequentialism, Beneficence
23. It is the responsibility of a health care practice to ensure that all employees are healthy, physically, mentally and psychologically.
- True
  - False
24. Identify the INCORRECT statement. The ethical principle of Non-maleficence:
- includes the obligation not to cause harm or to inflict the risk of harm
  - is implicitly espoused in the Hippocratic Oath
  - requires practitioners to honour the inviolability of the patient
  - provides no basis for accusations of negligence
  - implies that a "reasonable clinician" has a duty to act (i) sufficiently carefully; (ii) act lawfully and (iii) loyally, by providing appropriate care with the least amount of harm
  - duty of care is a negligence concept, which implies that a clinician would be negligent if he fails to use due care under specific circumstances

25. Whilst the ethical principle *First do no harm* may be regarded as a prime directive, it is nevertheless recognised that as an objective it is impractical, unattainable and unjustifiable within the clinical context, and assessments must also include the obligations of beneficence, autonomy and justice.
- True
  - False

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