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Small to medium sized shrubby tree with brown/red new leaves, dark brown bark and orange sap. A native African plant with antimicrobial properties, proven against all oral bacteria. Used in traditional medicine as mouthwash and infusion for direct application.

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Orbits of interest

Astronomers have a word for it… the point at which orbiting bodies are closest to each other is termed the periapsis….

And if one of the orbiting bodies is the earth, that closest approach is called the perigee. In October we experienced a periapsis of two crucial bodies of movement… our own orbit of Oral Health month in September and the orbit of Breast Cancer month in October. We would do well to observe both with commitment and enthusiasm. Superimposed at this time has been the all-pervading devotion to the Rugby World Cup,… and many rugby players wore the pink band of Breast Cancer Awareness.

The most prevalent cancer amongst women, breast cancer accounts for some 20% of all female cancers. In 2010, there were 6125 new cases diagnosed. Males are also prone but at lower levels, with 135 new cases in 2010 and comprising only 0.5% of cancers. (By contrast, neoplasms in the mouth amongst males contributed 394 new cases at an incidence of 1.45% and tongue lesions recorded 322 new cases, at 1.19%. In females the figures are lower, mouth at 197 and 0.66% and tongue at 117 and 0.39%.)

Dental disease remains a scourge. We need look no further than the paper included in this issue in which dental caries status in six-year-old children is reported by Drs Reddy and Singh after their study conducted at Health Promoting Schools in KwaZulu-Natal, South Africa. The caries rate for their sample was 73% and 94% of the children required some form of treatment. In all assessments, the statistics revealed a deteriorating situation compared with data gathered in previous surveys in 1988 and in 2000. Tellingly, the sample indicated that we are far from achieving the goal set by the Department of Health that 60% of six year olds should be caries free.

By contrast the statistics for breast cancer do offer some small encouragement for with improved diagnosis and the recognition of preventive measures the survival rate can be as high as 93%. Cancer Association of South Africa

As the two orbits approach each other there are obvious similarities… in both instances Prevention and Early Diagnosis are paramount. Several controllable factors have been implicated in the aetiology of breast cancer, although the relationships may not be direct. Intriguingly, diet is one of those factors identified as important in preventing the condition. High intake of fat, a diet high in animal protein, alcohol in excess of two units a day have all been mentioned as contributing to the risk. The National Breast Cancer Foundation recommends that the risk can be reduced by:

- Maintaining a healthy weight
- Staying physically active
- Eating fruits and vegetable
- Regular self examination and mammograms
- Not smoking
- Limiting alcohol consumption

Dental disease may be prevented by the time tested and well known measures of personal care, chemotherapeutic intervention and control of diet:

- Meticulous oral hygiene
- Reduction or elimination of intake of refined sugar
- Fluoride, either as topical application or incorporated into water supply
- Regular dental inspections and treatment.
- Antibiotics offer a direct control over oral bacteria.

These preventive interventions are parallel, not identical. In every instance it is control of personal habits that is the key.

The orbits of the two conditions certainly approach closely and that very periapsis emphatically recognises the wide responsibilities of all health professionals in their roles as advisors, educators, monitors and deliverers of treatment. Perhaps we are closer to the role of the earth as the body having more obligations to meet and the correct term for that close approximation of orbits would be perigee. How did we do in September, Oral Health Month… and how do we compare with Breast Cancer month in October?
A new initiative

ASK THE EXPERTS

The issue of the free sharing of education and knowledge and acumen has been so much in the public eye recently that it is probably a good time to launch a concept which has actually been on the Journal back-burner for some time. It is an approach which will be designed to provide members with access to advanced knowledge and experience.

Coming from UWC in the person of Dr Nadia Mohamed, a member of the Editorial Board, is the suggestion that the Journal should open a regular feature which could be titled “Ask the Experts.”

Any reader who faces a challenging case, who is grappling with a partial denture design, who is undecided whether crowns should be placed or perhaps dentures may be best, who just cannot find that aberrant root canal, who has a difficult decision as to whether the bite should be raised by an overdenture, the dilemma of the patient presenting with an oral medicine conundrum, the list can extend ad infinitum. You will of course have gathered the idea... that any reader who has a case on which advice would be appreciated could approach the Journal. We in turn will seek out the kind cooperation of an expert in the field of endeavour, solicit the opinion and guidance and prepare a response.

The correspondence will be published together with appropriate records. Ideally, the case would be followed through and the outcome after finalisation of treatment would be published.

Looks like a Win Win situation, for practitioner, for patient, for all readers in fact a Win Win Win arrangement.

It would be great to commence the feature in our first issue next year February. So this is an invitation to share your problem case, seek and receive advice, tell us how you and the patient fared, and everyone reading the case will have benefitted.

Send your case or cases through to Edith. E-mail a history, details of clinical examination, appropriate radiographs and photographs of models and/or of the patient. State your dilemma and make clear where you seek advice.

(EDube@sada.co.za).

What about alternative opinions, you may ask? Of course the cases would be open to full correspondence so a consensus of opinions may be possible. BUT more importantly the freedom to debate the merits of one or another treatment approach is surely in line with the philosophies which our students are so earnestly seeking.

And it is that time of the year, so we wish our students success and fulfilment as they face the end of year assessments, disrupted though they may have been.

SADA
Annual General Meeting (AGM)

Notice is hereby given that the Annual General Meeting (AGM) of The South African Dental Association (SADA) NPC will be held on

Thursday 17 March 2016 at 18:00
Sunnyside Park Hotel, Parktown, Johannesburg

Agenda for the meeting will be posted on the SADA website.

SADA is your Association and your voice counts.
PERSONALITY: RECOGNITION OF A LIVING ICON

Professor Daniel Philip Barnard
Emeritus Professor: Medical University of Southern Africa (Sefako Makgotho Hospital)*

Born and bred in Gansbaai where his father was the School Principal, preacher, medicine man, Sheriff, reconstructor of the little fishermans’ village and the representative of various State Departments.

At the end of 1945, at the age of sixteen, Daan Barnard passed Matric at the Napier High School, where he also excelled in rugby and athletics.

Due to several reasons, tertiary education for Daan was not possible at that stage and at the age of 17 he joined the SAP. After completion of a six month training course at the SAP Training College in Pretoria, he was stationed at Marshall Square, Johannesburg with a net monthly income of eight pounds. He soon realised that he was on the wrong track and eventually bought his discharge for 20 pounds, which he had to borrow from his father (a considerable amount of money those days).

At the beginning of 1948 he registered as a student at the Teachers Training College, Paarl, and completed a three year course for a Higher Teachers Diploma, which he obtained with distinction. During his studies he was the Class Representative for all three years, served on the SRC, was leader of the College orchestra, a play actor and also played a good game of tennis and of rugby (with Springboks Buks Marais and Chum Osche).

1951-1953. Teacher in handcraft-wood and metal at various schools in Kimberley and also acted as Honorary Secretary of the SA Teachers Association, Northern Cape Division. He was one of the first teachers to integrate the teaching of basic principles of woodwork with the production of useful items (in this case toys) for which he was highly praised. It was here, in Kimberley, that he married Gerda Dreyer, a fellow student and ex-Ikey, who qualified in the teaching of hard of hearing and speech defective children.

In 1953 he was accepted for registration as a student for the BDS degree at The University of the Witwatersrand, Johannesburg, on condition he passed mathematics at matric level, a subject that he did not have at school. In a do it yourself course of nine months, he managed to pass the maths that covered the syllabus Std 7 to Std10 and triumphantly registered as a student in the Dental Faculty, beginning of 1954. Fortunately his wife, who was now the breadwinner, managed to secure an appointment at Spes Bona School in Braamfontein, which had special facilities for her category of teaching and was also conveniently situated between the Oral and Dental Hospital and Medical School at that time.

During his studies at Wits he served on the Students Dental Council as Treasurer and was the Class Representative in the fourth and final years. He also took part in the annual Dental Rugby intervarsity against Tuks. In the third year of study, Daantjie, as he was known amongst his fellow students, was acknowledged by the Prosthetic Department for a dental set-up he successfully completed for a patient with a prominent pre-maxilla, a case which the full time technicians could not see their way through. Surgery had been considered the only alternative.

A self-trained pianist, he found a way to augment their income by playing cocktail music at various entertainment localities, inter alia, the old Victoria Hotel in the city and the Bryanston Country Club. An almost unprecedented incident for those days that he’ll never forget was the occasion when one of the senior lecturers, later to become Dean of the Faculty, invited Daan and his wife over for a drink, with the request that he offer entertainment on the piano. On his departure that evening the doctor’s words were “If you write your exam with the same excellence that you play the piano, you’ll definitely pass with distinction”. He never got the distinction but passed comfortably and at the same time passed a piano test for the early morning programme on Springbok Radio.

Daantjie, apart from being a good dental technician, was a competent motor mechanic. He fixed and tuned motorcars for his fellow students and supercharged his own Morris Minor from a slow side valve to a lively overhead engine with a four branch exhaust system.

*This tribute prepared by Piet Botha and Bill Evans, long time colleagues of Daantjie, drawing from his CV.
Gerda and Daan welcomed their first child in June of the Final Year, a joyful occasion but one that made the road to the final examination extremely tough.

After qualifying for the BDS (Wits) degree, the now Dr Barnard bought a practice from the late John Brice, ex Wits, in Aliwal North where he practised for ten years. During these years Daan played a prominent role in the community with entertainment and charity work on the piano and electric organ. During a holiday in Margate he also won a talent competition with his performance on the Hammond Organ. He started playing golf and progressed to a single handicap golfer in a relatively short period of time. Dr Barnard was a member of the Executive Committee and Treasurer of the Golf Club, (founded in 1989) and on occasion, the Captain. He was also appointed as an Honorary Vice President of the Eastern Cape branch of the Dental Association of South Africa in Port Elizabeth. His wife, Gerda, apart from being a superb housewife and mother, applied her knowledge as a Speech Therapist to cure children as well as adults, especially stutterers, who came to her for help. She was also called upon to be an actor/Producer for the local Dramatic Society.

In his practice he was deeply interested in methods of pain, stress and anxiety control and made use of the so called white sound and his own recorded music, via earphones that could be controlled by the patient, with varying success. This was also the beginning of his lifetime research work on the pharmacology and local and systemic adverse reactions of local anaesthetic injections, a factor that was of concern to dental and medical practitioners worldwide.

1969-1979. Daan held appointment as a dentist for the Sasol Medical Fund and played golf at the Emuleni and Maccauvei Golf Clubs.

1970. Prof Barnard’s academic career started with his appointment as Senior Lecturer in the Department of Maxillo-Facial and Oral Surgery in the Faculty of Dentistry at the University of Pretoria where his responsibilities included the teaching and clinical training of pre-graduate students in minor oral surgery, the pharmacology and techniques of administration of local anaesthesia, asepsis and sterility and operating theatre procedures and techniques. He also lectured to the Oral Hygiene students on dental procedures and therapeutics.

Dr Barnard was a full-time member of the Faculty Board, the Dean of Students, acted as Head of Department on several occasions and was granted Masters degree status by the Faculty Board. He was a member of the SA Dental Association and President of the Odontological Society (Northern Transvaal branch). For three successive years he arranged and conducted, with the support of the Surgeon General and the Fourth Year students, a skeleton emergency dental service in Pondoland, Transkei, meeting the oral health needs of hundreds of patients at a time.

In 1976 Dr Barnard was appointed Chief Dentist for the Department of Health and Population Development, on condition that he retained his lecture input at UP and Medunsa (Sefako Makgotho Hospital). He was also granted permission to carry on with his research on local anaesthesia, which he had started at the UP Dental School.

An enormous challenge that waited for him in his new office was the implementation of a National Dental Health Policy, formulated by his new boss, Prof Leon Taljaard. The objective of this policy was to make comprehensive dental services available to all the peoples of RSA.

This demanded his personal attention to establish facilities in order to render dental services in all hospitals (rural hospitals and clinics to be a priority), mental institutions, all prisons, old age homes and all those people in need that could not afford or were not within reach of clinical services... a tremendous task under the ruling laws at the time. To run such clinics, manpower was critically necessary and for that reason, a new category of dental clinicians was introduced. Dental Therapists, following a two year licentiate course, were trained to render basic dental services and pain relief. Oral hygienists were trained and appointed to do very necessary preventive and educational dental services, especially amongst children. The private sector became involved by introducing district dentists and specialists on a part time basis.
The Universities with Dental Faculties had to maintain teaching hospitals with their clinical service components, and soon encountered the problem of having to allocate additional sums to carry the costs of the clinical output and maintenance of their Oral and Dental Teaching Hospitals, leading to unhappiness amongst the other Faculties. This was not supposed to be part of the function of a University. Eventually the Department of Health was approached to find a way in which the service rendering component of the Dental Faculties could be taken over by a State authority. After many negotiations, Wits Dental Faculty was the first to agree to merge their academic component with the service rendering component which was then fully administered and financed by the Dental Branch of State Health and which included the cost of expanding existing dental facilities. Joint posts for academic personnel were introduced on a voluntary basis.

Dr Barnard was now promoted to the position of Director of Dental Health Services, and was commissioned to supervise the functioning of dental teaching hospitals. He found it exciting to be so closely involved with his Alma Mater. He served on both the Joint Advisory and Selection Committee and the Building and Maintenance Committee of Wits University. During this period Dr Barnard was also actively involved in the take-over of all the Provincial school and clinical dental services which created a position in which all community dental services were under one blanket.

He was also a member of the Joint Advisory and Selection Committees of the Universities of Western Cape, Durban Westville and Medunsa (Sefako Makgotho Hospital) and held appointment to the Planning Advisory Committee concerning the dental hospitals for the latter two institutions. He also served on the Steering Committees involved in the merging of the dental hospitals of the Universities of Stellenbosch and Western Cape.

Other committees of which he was an active member:

- The sub-Committee (Dental) of the General Advisory Committee on Health Matters
- The Committee for Preventive Dentistry of the SA Dental Association of South Africa. He was the first person who handed a cheque of State origin to the Association in favour of the National Dental Health Week.
- The Standing Committee on Dentistry of the SA Bureau of Standards, representing the Association and the Department of Health. He was a pioneer and is still active in establishing and maintaining a high standard of quality and safety for local anaesthetic practice in this country.
- Member of the Executive Committee of the Pretoria Branch of the Association, responsible for staging scientific programmes at meetings.
- The SA Society for Maxillo Facial and Oral Surgeons.

He was the first full time government official to be an active member of the SA Division of the International Association for Dental Research, which he maintained for twenty years. His membership gave a boost to Community Dentistry, a new academic development introduced by the Department of Health, and who delivered ever-increasing contributions to the Annual Congresses of the IADR.

Dr Barnard held membership in numerous professional societies:

- The subgroup, Pharmacology, Therapeutics and Toxicology
- A founder member of the Association for Maxillo-Facial Radiology.
- The International Association for Forensic Odonto-Stomatology and founder member of the SA Division. In his position as Chief Dentist, he instituted, with the support of the SAP, a National Dental Forensic Service by creating joint posts at the different dental faculties for this purpose.

Concurrent with his activities in the Health Department, he proceeded with part time teaching and lecturing to dental auxiliaries and dental students and pursued his research on local anaesthesia.

In 1983 Daan Barnard was appointed as Associate Professor in the Department of Oral Surgery at the Medical University of Southern Africa (Sefako Makgotho Hospital) where he became a full member of Senate and served on seven different Faculty and Hospital Committees.

He also held an honorary appointment in the Department of Pharmacology and Therapeutics in the Medical Faculty with the purpose of coordinating the Pharmacology curriculum for dental and dental therapy students, lectured to pre and post graduate Medical students and simultaneously found a valuable boost for his research into local anaesthesia.

In the process he became a member of:

- The SA Pharmacology Society where he delivered papers
- The SA Neuroscience Group.
- The International Brain Research Organisation

After a national survey to determine the use of and problems related to local anaesthetic practice in the RSA, and having completed international literature scans and several clinical investigations, he decided to compile a book in a popular/scientific format that could be used as a reference by general dental and medical practitioners as well as students, making it a valuable contribution to his profession instead of a thesis that normally settles on a library shelf.

In 1987 he requested a transfer to the Department of Oral Pathology and Biology and became the Head of the Oral Biology Division, which he promoted with enthusiasm. He continued with teaching and research on local anaesthesia. During this time he was called upon by the Medical and Dental Council to inspect the stature of the subject Oral Biology as presented by the Dental Faculty of the University of Stellenbosch. It was his conviction and he also stated it pertinently that the subject Oral Biology must be integrated with clinical teaching throughout the years of study. Prof Barnard for several years acted as External Examiner for the final exams of the Oral Hygienists and dental therapists at the University of Durban Westville.

In July 1991 he was out of the blue struck down by a herpes encephalitis which landed him in the intensive care unit of the Eugene Marais Hospital where they fought for
his life. This was the first time he had had to stay away from work as a result of illness. Fortunately and by the grace of God, as he remarks, he survived but had to go through a lengthy process of rehabilitation. He recovered remarkably well but was forced to retire and was awarded the status of Emeritus Professor, with retention of his title, by the Council of the University... a proud way to retire.

Eventually he gradually picked up the endless amount of data which fortunately had been saved on his computer and was extremely proud to launch the first edition of his life-long undertaking, his book* Hazards of Local Anaesthetic Injections* in August 1994, an occasion that was concurrent with his twentieth attendance of the Congress of the SA Division of the International Association of Dental Research. He received an abundance of local and foreign compliments and appreciative comments on his publication. It was also well accepted by the Dental Schools as a prescribed book. “Hazards of Local Anaesthetic Injections” is the first and only book on this subject published by a South African author in the RSA and he was proud to receive an order from the Library of the American Dental Association. Soon, Prof Barnard was being requested to give lectures at the different branches of the DASA, was consulted by dental as well as medical practitioners and specialists, medical schemes, the SABS pharmaceutical suppliers and academic personnel. He had several requests from the Medical and Dental Council to investigate and comment on cases reported by patients of alleged malpractice apropos of local anaesthetic practice. On one occasion he was summoned to court to give expert opinion subsequent to the death of a young man suspected to follow a lethal oral intake of lignocaine. In 1996 he received Honorary Membership of the then Northern Transvaal division of the Association at which ceremony he was honoured as a pioneer with reference to the establishments of standards for safe and effective local anaesthesia in RSA. Based on the years of research he managed to persuade local manufacturers to delete paraben preservatives from their products and also had a favourable effect on some overseas producers from whom local anaesthetics were imported. With his close association with the Medical Director of Adcock Ingram at the time, he was also actively involved in the formulation and production of a very efficient analgesic with combined anti-inflammatory and anti-histaminic effects that is inter alia very effective in post-surgical cases.


In May 2001, on his 72nd birthday, the Professor attended the Second Milestone International Training Course as a guest of honour and was applauded by the delegates of eight overseas countries for his excellent publication - of which all were in possession. He received requests from academic institutions of two European countries, Poland and Turkey, for permission to translate his book.

With the objective of compiling a book on local anaesthetics that is more condensed and easier to consult he published a booklet based on questions and answers, containing coloured illustrations and entitled “A Practical Approach to Hazards of Local Anaesthetic Injections: Questions and Answers” in 2004. This publication was highly praised by the Editor of the South African Dental Journal and on his request it was released for serial publication.

He received an invitation to become involved in a project investigating the direct effect of local anaesthetics on cell growth and function of non-neurogenic tissue and is part of the research team in the Department of Anatomy, Basic Medical. Sciences, University of Pretoria.

Prof Barnard’s relevant publications, abstracts, memorandums and lectures to selected audiences, local and international, count in the vicinity of sixty five. He has also been a consultant and is quoted in two textbooks of Pharmacology. He has acted as referee for several articles published in the SADJ. He is still keeping up to date with the advancement in his field and renders a complimentary informative telephonic and email service to anyone in need.

He also has made an intensive study of natural health food supplements and the side effects caused by preservatives and other additives present in processed foods. Daanjie has built up a substantial collection of literature and books on the subject and attributes his magnificent recovery to a large extent to the use of natural food supplements and has guided many friends and family on the right track as far as their health is concerned and finds that exciting and stimulating.

Prof Barnard remains a student and keeps up to date with scientific advancements in his field of interest. He receives the weekly interactive e-bulletin MedicalMail for Health Professionals which allows easy contact with medical opinion leaders worldwide.

He and his charming wife Gerda are blessed with five children and eleven grandchildren and if he is not reading scientific books and articles, he spends his time on his Yamaha keyboard and produces his own CDs with soft and sweet music of yesterday.
An investigation into the incidence and distribution of fractures of the coronoid process in patients presenting at the Sefako Makgatho Health Sciences University, Oral Health Centre

AS Singh¹, MMR Bouckaert², JM Mchenga³, CJ Perumal⁴

ABSTRACT
Isolated coronoid fractures, especially those that are due to direct trauma are very uncommon because the coronoid process is anatomically sheltered by the zygomatic complex, and the associated muscles. Further, such fractures can easily be missed. The causes of coronoid fractures include road traffic accidents, interpersonal violence, gunshot injuries, third molar extractions, pathology and bilateral sagittal split osteotomies.

The aim of this study was to assess the incidence and distribution of coronoid fractures among trauma patients who had presented to the Maxillofacial and Oral Surgery Department, Sefako Makgatho Health Sciences University, between the years 2005 to 2008. One thousand seven hundred and fifty five patients who reported to the Oral and Dental Hospital had sustained facial bone fractures, of which one thousand two hundred and twenty two had suffered mandibular fractures. Fifteen (1.23%) of these patients were found to have a fracture of the coronoid process. The main causes of injury were seen to have been gunshots and assault, with the latter having been the major contributor. All the coronoid fractures were treated conservatively.

INTRODUCTION
The mandible is a horse-shoe shaped bone with various anatomical features such as the coronoid process, condyle, ramus, angle, body, symphysis and alveolus occurring bilaterally. The coronoid process is located anterior to the condyle and superior to the mandibular notch. It provides attachment to the temporalis muscle. The weakest sites are believed to be the third molar, the canine teeth and the condyle areas. The arterial supply of the mandible is derived from the external carotid artery through the maxillary artery, a branch of which forms the inferior alveolar artery that passes through the mandibular canal and exits through the mental foramen as the mental artery.

Fractures of the mandible are classified based on the type and the anatomical site. The types of fractures may be classified as either greenstick, simple, comminuted, compound, displaced or undisplaced and pathological. Anatomical sites of the fractures may be classified as dentoalveolar, condylar, coronoid, ramus, angle, body, parasympysis and symphysis fractures. Shen and co-workers classified coronoid fractures as: fracture of the coronoid base; of the upper coronoid process; comminuted fractures of the coronoid process and those affecting both the coronoid process and the mandibular ramus.

Fractures of the coronoid processes are uncommon because the structure is anatomically sheltered by the zygomatic complex, and the associated muscles. Clarkson and co-workers first reported coronoid fractures among British troops during World War II. The etiological factors of coronoid fractures include road traffic accidents, interpersonal violence, gunshot injuries, third molar extractions, pathology and bilateral sagittal split osteotomies.
When evaluating mandibular fractures, it is necessary to obtain a clinical history and to perform a physical examination. Fractures should be suspected in severe cases of trauma, especially when there has been high impact. A blow from a fist often results in a single, non-displaced fracture. Motor vehicle accidents are usually associated with multiple fractures which are often comminuted. A blow to the chin may result in bilateral condylar fractures. An angled blow inflicted laterally to the parasymphysis area may cause contralateral condylar or angle fractures. The different types of displacements of fractured segments are often determined by factors such as the direction and degree of force, the integrity of the periostium, the extent of interdigitation of the fractured ends, the direction of the fracture lines and the pull of the muscles which insert on the mandible. Patients with coronoid fractures usually present with pain and limited mouth opening. Treatment is dependent on the amount of displacement present together with clinical signs and symptoms. Severely displaced fractures often are treated surgically by open reduction, whereas undisplaced fractures are usually treated conservatively or by closed reduction. Untreated coronoid fractures may result in adhesions of the fracture segment to the surrounding tissues resulting in fibrous ankylosis.

The current retrospective study of coronoid process fractures is the first to be conducted at the Department of Maxillofacial and Oral Surgery, Sefako Makgatho Health Sciences University.

LITERATURE REVIEW

Several factors contribute to fractures of the coronoid process. Most are due to direct blunt or penetrating trauma. Iatrogenic causes such as extractions of maxillary and mandibular third molars, cystectomies and sagittal split ramus osteotomies can contribute. Coronoid fractures have been divided anatomically into intramuscular and submuscular fractures. (Figure 1.)

A retrospective study in Baghdad reported an increase in the numbers of patients presenting with mandibular fractures. The study also showed a male predominance, a result similar to that reported in other studies. The pattern of etiology in Baghdad was found to have been assault and falls from a height, which over the last 10 years has changed to bullet and shell injuries. During the period 1995 to 1996 there were two coronoid fractures recorded among 150 mandibular fractures. This however, has changed. Data gathered over the period 2005 to 2006 recorded one coronoid fracture among 100 mandibular fractures. Trends in the treatment of mandibular fractures were analysed over a five-year period, 2007 to 2011. The study including 335 patients who had sustained 406 mandibular fractures. There was a higher incidence among males with a mean age of 28.5 years. The most commonly fractured site was the condyle (36.2%) and the least common was the coronoid process (0.5%). The majority (92.5%) of the patients were treated by open reduction.

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A 2% deformity in bone is sufficient to trigger a fracture process. Boole and co-workers (2001) reported a 1% incidence of coronoid fractures among 5196 patients. In a study conducted in India, 2103 mandibular fractures occurred amongst a total of 2901 facial bone injuries. Road traffic accidents were the major contributing factor to mandibular fractures. Three percent occurred in the ramus of the mandible while the least frequent fracture affected the coronoid processes (2%). Closed reduction (78%) was the preferred form of treatment modality for the management of the fractures.

A five-year study of 237 patients in Iran over the period 1996 to 2001 revealed 173 mandibular fractures. The majority occurred in the condylar region while 29.3% were located in the symphyseal and parasympyseal regions. Least frequently, the coronoid processes were found in 1.2% of the 173 fractures. In another study, fifty two cases were reported with coronoid process fractures, which constituted 2.9% of all facial fractures evaluated. Twelve were isolated coronoid fractures (23%) while the remainder of the 40 cases were associated with other maxillofacial injuries. (Figures 2, 3, 4 and 5)

While road traffic accidents remain the main cause of mandibular fractures, a case reported in Japan revealed that the probable cause of coronoid fractures in that

---

Figure 1: Classification of coronoid process fractures of the mandible according to Naitō and colleagues according to the insertion of the temporals muscle. Fractures within the auricular enshethment are termed intramuscular; those outside the enshethment are termed submuscular. Submuscular marginal fractures occurred at the edge of the attachment, marginal fractures occurred beneath the muscular attachment. (Extracted from Yaremchuk, 1992)

Figure 2: Three dimensional Computed Tomography showing fractures of the coronoid process and the condyle of the mandible.

Figure 3: Panoral radiograph showing fractured condyle and coronoid process of the mandible.
instance to have been an acute reflex contraction of the temporalis muscle. This break was associated with a subcondylar fracture which occurred indirectly. Another case of bilateral reflex muscular contraction causing fracture of the coronoid process was reported in Wales. These fractures had occurred after a blow to the left temporal region after an assault. There was no evidence of direct trauma to the facial bones, hence, the probable cause of an acute reflex contraction of the temporalis muscles is plausible.

An aneurysmal bone cyst occurring in the left coronoid process was seen in a 17-year-old male patient in India. The cyst was surgically removed via a superior approach to the temporal fossa via a pre-auricular incision. The procedure required the fracturing of the left coronoid process. Whilst this may be regarded as an iatrogenic fracture, if the lesion was not removed, the coronoid process would have remained prone to fracture.

TREATMENT

Treatment options for mandibular coronoid fractures range from no treatment in isolated non-displaced fractures of the coronoid process to open reduction in cases of severe displacement. Reduction is essential when the fracture fragment impinges on the zygomatic bone, resulting in trismus. An unusual fracture occurred in Boston in a seizure-prone patient. There was an oblique submuscular displaced fracture running from the depth of the mandibular notch to a point immediately behind the distal end of the alveolar process. Treatment required reduction and internal fixation, using plates and screws, hence avoiding intermaxillary fixation in that susceptible patient. All the coronoid fractures in this study were treated conservatively.

MATERIALS AND METHOD

For the purpose of this study, the coronoid process was defined as the triangular antero-superior extension of the ramus of the mandible as depicted in Figure 6.

Radiographic and clinical data spanning a three year period (1 January 2005 to 31 December 2008) were obtained from the files of patients in the Department of Maxillofacial and Oral Surgery, Sefako Makgatho Health Sciences University. The records of 4000 patients who had presented with trauma-related maxillofacial injuries were retrieved from the clinic archives. The cause, nature of injury and patient demographics such as gender, age and date of injury of those patients who had a fracture of the coronoid process were recorded in a data collection sheet and analysed in Microsoft Excel.

RESULTS

One thousand seven hundred and fifty five patients had sustained facial fractures. One thousand two hundred and twenty two patients had suffered mandibular fractures. Fifteen (1.23%) of these patients had undergone a fracture of the coronoid process.

Age

The age distribution is demonstrated in Table 1. The mean age was found to have been 33.6 years.

Gender

All 15 patients were males.

Cause of injury

There were two causes of injury, gun shot wounds (GSW) and assault, the latter having been the major contributor. Table 2 summarises the cause of injury.

Site of injury

There was no obvious side predilection. (Table 3).

MATERIALS AND METHOD

For the purpose of this study, the coronoid process was defined as the triangular antero-superior extension of the ramus of the mandible as depicted in Figure 6.

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TREATMENT

Treatment options for mandibular coronoid fractures range from no treatment in isolated non-displaced fractures of the coronoid process to open reduction in cases of severe displacement. Reduction is essential when the fracture fragment impinges on the zygomatic bone, resulting in trismus. An unusual fracture occurred in Boston in a seizure-prone patient. There was an oblique submuscular displaced fracture running from the depth of the mandibular notch to a point immediately behind the distal end of the alveolar process. Treatment required reduction and internal fixation, using plates and screws, hence avoiding intermaxillary fixation in that susceptible patient. All the coronoid fractures in this study were treated conservatively.

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The frequency of isolated coronoid fractures and in association with other facial fractures.

Table 4 presents data showing how coronoid fractures occurred alone or in combination with other mandibular fractures.

DISCUSSION

The prevalence and incidence of coronoid fractures varies only slightly in geographic distribution. In Brazil, a 1% incidence of coronoid fractures among 5196 patients was reported whereas in India a 2% incidence among 2103 patients was reported and in Greece a 2.9% incidence was reported. This study found a 1.23% incidence of coronoid fractures among 1222 patients who had sustained mandibular fractures. This equated to a 0.84% incidence among the 1755 patients who sustained facial fractures.

The cause of injury varies in different regions. In Japan, road traffic accidents were the major contributing factor to coronoid fractures. Coronoid injuries are not only related to trauma, however but also may be due to acute reflex contraction of the temporalis muscle. Pathology in the region of the coronoid process has also been cited as a causal factor in such fractures. In Baghdad the trend in etiology changed from assaults and falls from heights to bullets and shell injuries. This South African study found gunshot injuries (13.3%) and assaults (86.7%) to have been the two contributing factors. None of the patients sustained a coronoid fracture due to acute reflex contraction of the temporalis muscle, or to pathology.

The literature does not report extensively on age or gender in relation to the occurrence of coronoid fractures. Only males were affected in the current study. This study found an age distribution of 20 to 59 years with a mean age of 33.6 years. The majority of the injuries occurred in the 20 to 29 year age group. Although in this study there was little difference in the side affected (47% to 53%), any tendency, it may be speculated, could be due to the left or right handedness of the assailant in the case of assault.

Most coronoid fractures of the mandible occur in combination with other facial injuries. A 1985 literature search project revealed 52 reported cases of coronoid process fractures, which constituted 2.9% of all mandibular fractures. Twelve were isolated coronoid fractures (23%) while the remaining 40 cases occurred in association with other maxillofacial injuries. Another study reported that the propensity of coronoid fractures occurring in the presence of pathology in the mandible may be increasing.

In the current study 60% of the cases presented as isolated coronoid fractures, while 40% were in association with fractures at other sites in the mandible and facial bones. The highest number of coronoid fractures (13.33%) was associated with Le Forte I fractures. The treatment for these fractures varies depending on the severity of the fracture. Yaremchuk (1992) treated the fractures with open reduction and internal fixation. All fractures in the current study were treated by conservative means. No long-term follow up reviews of these patients were carried out, but the records showed that within the time limits of the study, no patients returned with any fracture-related problems.

CONCLUSION

It is evident from the results of this study that mandibular coronoid fractures are rare. The aetiology varies from pathology to trauma. Males are affected more than females, as males are generally more exposed to violent insults. Although coronoid fractures are the least reported among mandibular fractures, they deserve attention. Treatment methods remain controversial. The general consensus is to treat coronoid fractures conservatively. However, there are no studies to date which compare the efficacies of different treatment modalities, nor the long term effects of such treatments.

Although not much attention seems to be given to mandibular coronoid fractures, the pain and discomfort and long term outcomes, such as trismus and anklyosis, make the issue worthy of discussion and attention.

References

Managing stress in the dental environment

Stress is defined as “an imbalance between a perceived demand (stressor) and a person’s perceived ability to cope with, or to meet, that demand”.

The key stressors in dentistry are:

(i) running behind schedule;
(ii) causing pain;
(iii) heavy workloads;
(iv) late patients and
(v) anxious patients.

So what can dentists do to deal with stress, to find ways to deal with it and leave them more in control, less anxious and ultimately, less stressed? Can you avoid the stressor? Can you minimise the stressor? Can you handle the stressor differently? A professional person needs to act in a way which is seen as being appropriate and proper by both their patients and professional colleagues. By adopting a positive attitude to both work and life, the treatment and management of patients can be seen to be caring and non-judgemental. Often inappropriate comments by professional colleagues that may suggest a lack of integrity, inferior abilities or stature are unethical and best avoided as they can quickly cause an emotional fall out and anger that may become destructive. The triggers for such disputes are often professional rivalry, jealousy, wounded pride, a financial/business dispute and resentment which can sometimes result in inappropriate comments being made about a professional colleague. When dealing with stress, strategies that help to express feelings, particularly negative ones such as anger and sadness, are helpful. Professional disputes can be acrimonious, and they demand a high level of ethical awareness and restraint. With regard to anger particularly, it is more effective to talk one’s anger than to act it out. There is less chance of making a personal insult if dentists are regarded as incompetent when compared with their peers, or are seen as insensitive, inconsiderate and inferior to doctors. Attempting to stay on schedule in a busy dental practice is a chronic source of stress. Not receiving commensurate payment for their services, anxiety about the future and long working hours may also act as stressors.

Stress is not good for health! It is well known that stress and poor stress management increase susceptibility and vulnerability to ill health including cardiovascular disease, ulcers, colitis, hypertension, lower back pain, marital disharmony, alcoholism, drug addiction, mental depression and even suicide. How does stress manifest in the practice? It may result in absenteeism, increased incident rate, inter-personal aggression, poor quality control, low productivity, high aggression, low productivity, high turnover, reduced morale, complaints and litigation.

Having good social support networks is important to acquire opinions or assistance in times of need. This support could be from family members or friends, or others who may have specialised knowledge or training in the service professions, such as doctors, or psychologists and fellow dentists and colleagues. They will offer an ear and useful feedback that is appropriate to the problem at hand. When one uses past experience to deal with a current problem it can make it easier to predict an expected outcome. As one gains life experience, one becomes more adept at using this knowledge in a variety of different ways and in different situations. To the experienced dentist, the notion of “I’ve seen cases like this before and have dealt with them successfully” offers the confidence to predict that a current problem case will be also be successfully dealt with. However, when there is a loss of predictability, for example in unfamiliar situations, or a situation one is not equipped to manage, there is an increase in anxiety and stress levels. Unpredictable situations make stressors more stressful, and often one cannot predict nor influence subsequent events that will allow one to assume control.

The only possible area for the exercise of control is the notion of “I’ve seen cases like this before and have dealt with them successfully” offers the confidence to predict that a current problem case will be also be successfully dealt with. However, when there is a loss of predictability, for example in unfamiliar situations, or a situation one is not equipped to manage, there is an increase in anxiety and stress levels. Unpredictable situations make stressors more stressful, and often one cannot predict nor influence subsequent events that will allow one to assume control.

The only possible area for the exercise of control is the belief that one is in control and this is the key to self-management and effective problem-solving behaviour.

While it is useful to be optimistic when facing difficult issues, it is also important to acknowledge the possibility that things may not improve and that one needs to be imaginative, creative and courageous in finding new and innovative ways of dealing with difficult situations. Some authors have been more philosophical in their approach to
stress management. The notion of a life purpose can be as original, individualised and as innovative as we choose to make it. It may include finding ways to stimulate and develop personal growth, committing ourselves to a sincerely spiritual and religious life, aligning ourselves with a deeply-felt political cause, or making a lifetime commitment to the arts such as literature, music or painting. However, when it comes to issues of flexibility and adaptability, throughout a lifespan there are numerous milestones to be negotiated as each age demands new learning, new behaviour, and new roles that carry with them the obligation and readiness to meet the expectations society has of us as health professionals.

One learns to assume appropriate work and professional roles, so that we can become independent and reliable members of society, while simultaneously offering a service to the community. The pressure to keep up with the unrelenting stream of new information and the daily demands of modern dental practice is a constant challenge to the intellectual flexibility and adaptability of health professionals. These attributes may well be expressed through continued professional education and the acquisition of new knowledge. Dentists are encouraged to take communication skills training (including interviewing and listening skills) as well as financial and business management courses. In addition, the acquisition of skills that would assist in the management of fearful patients, as well as specific stress-relieving procedures such as relaxation, hypnosis, and desensitisation cognitive coping skills will be useful to alleviate potential stress.

Being ‘sad, mad, glad and bad’ are some basic emotions, and in essence refers to sorrow, anger, joy and fear/anxiety. They can readily command our attention, undermine our sense of control and subvert our rationality. However, if one is sensitive or attuned to one’s feelings and what causes them to be triggered, then one can deal with such reactions more effectively. In this regard, self-awareness is the key and by recognising emotions as they happen and adjusting them accordingly, insight and understanding can be achieved. This is more so when handling negative feelings, where it may be possible to convert aggressiveness into assertiveness, thus making it easier to regain and maintain self-control. Handling feelings so that they are appropriate is an ability that relies on self-awareness. One of the ways to manage the negative feelings that cause stress is to express them, but such expression needs to be verbal, not acted out. Mastering the skill of self-control allows a bounce back from setbacks, and shows social adeptness and personal effectiveness.

Managing and building good professional and patient relationships are important to avoid stressful conditions and environments. There are many strategies to achieve this including improving skills at conflict resolution, negotiating disagreements, greater assertion and skills in the art of communicating. Empathy, an understanding of how others feel, or having the ability to see the world through their eyes, is a fundamental people-skill. It is perhaps, the most important quality by which the dentist’s personal appeal and professional expertise are measured. In addition, good networking and relationship-building rests on an empathetic approach to dental care and, in the eyes of an anxious patient, you, the dentist, are actually responding to their unspoken need for nurturing and emotional support. It is probably the single most important “practice-builder” apart from clinical expertise and good diagnostic ability. It is a quality worth cultivating, not only to allay patient anxiety, but to boost self-confidence.

CONCLUDING REMARKS

Dentists are prone to professional burnout, anxiety disorders and clinical depression. While the root causes, stress and stressful situations, can never be totally eliminated from clinical practice, they must be reduced to avoid the many stress-related physical and emotional problems. The key to managing stress successfully is to first recognize and understand its causes. Once those have been identified and understood, preventive steps can be taken. People perceive and react differently to stress and a stressor for one person may not be a stressor for another. Choosing and implementing an approach or combination of approaches is crucial for effective stress management. Some of the preventive measures that could minimise the stress of dental practice are as follows (adapted from Lang, 2007):

1. Improve the working environment in the surgery;
2. Avoid isolation and share problems with fellow practitioners;
3. Work sensible hours and make time each day for a leisurely break;
4. Learn how to better handle patient anxiety and hostility;
5. Attend courses on stress management, and improving communication skills;
6. Adopt a programme of regular physical exercise;
7. Be kind to yourself and less critical and demanding of your efforts.

References

Fracture behaviour patterns of cusp-replacing fibre strengthened composite restorations

SADJ October 2015, Vol 70 no 9 p390 - p395
HJ Visser¹, PD Brandt², FA de Wet³

ABSTRACT

Objectives: To investigate and compare, in vitro, the fracture behaviours of three types of cusp-replacing posterior composite resin restorations.

Methods: Standard preparations for posterior composite restoration of the mesio-lingual cusp were cut on seventy-five extracted lower left first and second molars and restorations placed. Group A (control, n = 25) with a conventional posterior composite resin, Group B (n = 25): resin reinforced with nano-scale electrospun glass fibres Group C (n = 25): resin reinforced with a fibre substructure. Specimens were thermocycled for 500 cycles between 5°C and 55°C with a dwell time of 30 seconds, then embedded in plastic cylinders in acrylic resin. The specimens were loaded in a universal testing machine at a 30° angle to the long axis of the tooth until fracture occurred. Fracture patterns were highlighted by staining, studied under a microscope and classified as favourable (restorable) or unfavourable (non-restorable). Sub-classification included adhesive and cohesive failures.

Results: Group C exhibited significantly more “restorable” fractures. Group B displayed significantly more “non-restorable” fractures. Fracture patterns differed significantly between the two fibre-strengthening techniques. (Fisher’s Exact Test p = 0.05)

Clinical significance: Resin restorations reinforced with glass-fibre substructures are more readily repaired after fracture, saving tooth structure, and reducing costs to the patient.

Keywords: glass-fibre reinforcement, posterior composite resin restorations, fracture patterns.

INTRODUCTION

This article reports further on the research originally published in the 2014 SADJ Vol 69 p202-p207, and compares and discusses various fracture patterns in failed posterior composite restorations. Many different treatment modalities are available when restoring a tooth that has lost one or more cusps.¹⁻³ Although all of these protocols have proven track records, they are mostly costly, technique sensitive and often involve the services of a dental technician.²⁻⁵ In rural areas these services are often not available, resulting in a large section of the population not being treated. This leads to the eventual loss of restorable teeth. This research project investigated a more affordable direct composite technique.

Conventional methods to restore teeth with cusp-replacing restorations include direct and indirect composite restorations, direct or indirect metal inlays/overlays, ceramic inlays/overlays and in some cases full-coverage gold/ceramic crowns.⁶ Based on 2015 dental tariffs and including all laboratory fees if applicable, the relative costs were calculated in ZAR (Table 1). Whilst costs are lower, fracture of the composite material in the posterior region is a common reason for failure, particularly within the first five years.⁶⁻⁸ Judging from the number of failures recorded with the use of direct composite techniques to repair posterior cavities, including restoring lost cusps, it became clear that significant improvements in the mechanical properties of dental composite resins were needed in order to extend the use of these materials to these large stress-bearing applications.⁶⁻¹⁰ Their use in larger posterior restorations involving cusp replacement is further severely limited by the low flexural strength of composites.¹⁰ Furthermore, a restored tooth tends to transfer stresses differently than an intact tooth. Adhesive restorations transfer and distribute functional stresses across the bonding surface and also reinforce weakened tooth structure.⁴ SEM analysis of dental restorations confirmed clinical observations that composite resin restorations are prone to bulk fracture with crack propagation rates higher than those of porcelain.²⁻¹¹,¹² Finite element analysis showed that during mastication the inner side of the restoration can be in maximum tension,¹³ leading to fracture initiation.¹⁴

ACRONYM

CEJ: cemento-enamel junction
MOL: mesio-occlusal-lingual

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Extensive studies have therefore been undertaken on methods of improving and reinforcing the mechanical properties of these composite resins such as adding ceramic and porous fillers, optimizing the filler levels and/or using micro scale glass-fibres as fillers, as found in Aelite (BISCO, Schaumberg, Illinois, USA)..

It has been proven in various research projects that fibre reinforcement of composite resin strengthens the composite resin material. Recent research studies found that using fibre-reinforced composite as a substructure under composite restorations can improve the load-bearing capacity and may offer one alternative in overcoming some potential problems of composite restorations in high stress-bearing areas.

The location of the strengthening fibres is very important in the performance of the fibre-composite combination. It was found that tension side reinforcement was most effective in increasing the flexural strength as well as the static load-bearing capacity of dental restorations. However, some studies suggest that the incorporation of fibres not only increases the static load-bearing capacity of cusps-replacing restorations, but also has a beneficial effect on the failure mode and thereby on the restorability after fracture.

The fibres may act as a crack-deflecting mechanism, changing the fracture behaviour of the composite resin material to that of a material with quasi-ductile fracture behaviour.

The aim of this in vitro blind study was to examine and compare the fracture behaviour (fracture patterns) of a conventional posterior composite (Quixfill, Dentsply, Konstanz, Germany) used as the Control Group, a posterior composite resin incorporating micro-scale glass-fibres as fillers (Aelite, BISCO, Schaumberg, Illinois, USA) (Group B) and a conventional posterior composite (Quixfill) placed on a fibre sub-structure (everStick Crown and Bridge, Stick Tech Ltd, Turku, Finland) (Group C).

### MATERIALS AND METHODS

#### Specimen selection and preparation

Seventy-five intact, human lower left first and second molars were collected and stored in an aqueous solution of 5% chlorhexidine ($\text{C}_2\text{H}_5\text{Cl}_2\text{N}_1\text{O}_8$) at +8°C in a refrigerator. Informed consent for the use of the teeth for research purposes was obtained from all donors during the registration of the patient at the Oral and Dental Hospital, University of Pretoria. The specimens were selected to ensure anatomical consistency (i.e. tooth size, occlusal area, configuration of the fissures, etc.) in order that a standardized mesio-occlusal-lingual (MOL) cavity could be prepared. The teeth were all sound and had been extracted for reasons of periodontal disease. The donors were all aged between 50 and 70.

The preparation was standardized as follows: The cemento-enamel junction (CEJ) was located by visual examination. The mesio-lingual cusp was removed to a level one mm occlusal of the CEJ. A standardized MOL cavity was prepared using a number 142, size 018, dome-shaped diamond fissure bur in an air-rotor handpiece and under continuous water spray. All internal line angles were rounded. A proximal step of a depth of one mm was prepared, respecting the position of the CEJ. The width of the proximal box was determined by the occlusal anatomy of the specific tooth – the mesio-occlusal fissure was incorporated into the preparation as well as the mesio-lingual cusp. Each preparation was performed by one operator and examined for the correct dimensions by a second operator. If the preparation did not conform to the specified dimensions, the preparation was corrected (if possible); otherwise the tooth was removed from the experiment and replaced by another. The dimensions of each preparation were recorded.

The specimens were now randomly divided into three groups:

**Group A: Conventional Posterior Composite - Control (n=25)**

All enamel margins were bevelled. The specimens were etched with 37% phosphoric acid as follows: all enamel margins for 15 seconds, then all the exposed dentine (together with the enamel) for 10 seconds (selective etching technique). The acid was washed off with water. Care was taken to ensure that all acid was removed. The specimens were then lightly air-dried, ensuring that all dentine surfaces remained slightly moist. A bonding agent (XP Bond, Dentsply, Konstanz, Germany) was applied and light-cured, according to the manufacturer’s instructions. A Tofflemire matrix band was placed according to the manufacturer’s instructions.
Specimens in group A received a conventionally-filled composite resin (QuiXfill, Dentsply, Konstanz, Germany) restoration, placed according to the manufacturer’s instructions and using an oblique layering technique with incremental layers not exceeding 2mm. After the restoration was placed, it was polished using Shofu 411 diamond burs (Shofu Inc., Kyoto, Japan) and Enhance Polishing System (Dentsply, Konstanz, Germany).

Group B: Posterior composite resin incorporating micro-scale glass fibres (n=25)

Exactly the same technique was used as in Group A, except that the restorative material was a posterior composite resin restoration incorporating micro-scale glass-fibres as fillers (Aelite, BISCO, Schaumberg, Illinois, USA).

Group C: Posterior composite resin placed on a fibre sub-structure (n=25)

Exactly the same technique was used as for Groups A and B, including the placement of a Tofflemire matrix band. The inter-proximal step was then filled with a conventionally-filled composite resin (QuiXfill) restoration and light-cured according to the manufacturer’s instructions. A glass-fibre bundle (everStick Crown and Bridge, Stick Tech Ltd, Turku, Finland) was placed on the occlusal surface across the area of the missing cusp. The glass-fibre bundle was secured in position with a flowable composite (Esthet-Xflow, Dentsply, Konstanz, Germany). This acts as a luting cement, ensuring that no air bubbles are trapped between the fibre bundle and the bonded tooth surface and was placed according to the manufacturer’s instructions (Stick Tech Ltd, Turku, Finland). Close contact between the fibre bundle and the floor of the cavity was ensured by means of a silicon refix forming aid. The glass-fibre bundle was light-cured according to the manufacturer’s instructions. Specimens in Group C now received a conventionally-filled composite resin (QuiXfill) restoration, placed according to the manufacturer’s instructions and using an oblique layering technique with incremental layers not exceeding 2mm. After the restoration was placed it was polished using Shofu 411 diamond burs (Shofu Inc., Kyoto, Japan) and Enhance Polishing System (Dentsply, Konstanz, Germany).

All specimens were embedded in an acrylic resin cylinder (20mm diameter, height 20mm) with the CEJ approximately 1.5mm above the acrylic, which simulated the bone level. The cylinders were marked to distinguish the groups. All specimens were stored in saline and subjected to thermocycling (500 cycles between 5° and 55° centigrade with a dwell time of 30 seconds).

Testing: Specimens were then stored in saline (isotonic NaCl aqua solution, 9% by volume) for a minimum of 24hrs before testing. Each was sequentially fixed in a metal holder and positioned, using a specially made jig, in a universal testing machine (TestXpert V 11.02 Zwick 1446, Zwick Roell, Epental, Germany) with the long axis of the roots at an angle of 30 degrees to the direction of the load. The site of loading was the central fissure of the occlusal surface in the direction of the mesiobuccal cusp. A stainless steel cylindrical rod (tip diameter

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of 2mm$^3$ was used with a crosshead speed of 0.5 mm/min$^{23,33}$ to load the specimens until fracture occurred. The force needed to fracture the tooth was recorded on a PC. Testing of specimens was done randomly by an independent operator who did not know to which group each specimen belonged. Individual specimen numbers were allocated as the tests were being done. The part of the specimen that fractured off was collected, mounted on a transparent sheet and numbered for later investigation.

After testing, the fractured specimens were stored for 24 hours immersed in India ink$^{25,37}$ according to standardized protocols$^{38}$ in order to highlight the fracture lines. The failure modes were evaluated by two observers both visually and microscopically, using a stereo microscope at 10x magnification.

**RESULTS**

Table 2 gives the collated results on the fracture patterns. The results are explored in more detail as part of the Discussion. (Annexure 1, Table 2)

For fracture behaviour patterns, the groups were analysed in a contingency table using Fisher’s exact test. All testing were evaluated at the 0.05 level of significance.

**DISCUSSION**

Results of research have to be interpreted with care, even more so when biological material is investigated.$^{59}$ It is just not possible to control all variables, therefore specimens were carefully selected using anatomical criteria, age of the patient and position in the mandible. However, factors that might influence dentine bonding such as sclerotic dentine and dead dentinal tracts could not be controlled. On the other hand, sample size, tooth preparation, placement technique, specimen preparation, testing and analysis of results were easily standardized. Chlorhexidine$^{25-27}$ might not have been the best liquid in which to store the extracted teeth because of risks such as staining of the specimens and the possible effect on dentine bonding. These considerations were deemed beyond the scope of this article, which has focussed on fracture patterns. Chlorhexidine$^{25-27}$ might not have been the best liquid in which to store the extracted teeth because of risks such as staining of the specimens and the possible effect on dentine bonding. These considerations were deemed beyond the scope of this article, which has focussed on fracture patterns. Chlorhexidine$^{25-27}$ might not have been the best liquid in which to store the extracted teeth because of risks such as staining of the specimens and the possible effect on dentine bonding.

Fracture Patterns

Fracture patterns are broadly classified in the literature as either restorable (fractures above the simulated bone crest) and non-restorable (fractures below the simulated bone crest)$^{35,36,46}$

Fractures which were restorable occurred in 44% of cases (11 of 25 specimens) in Group A (control - QuiXfill), in 12% (3 of 25 specimens) in Group B (Aelite and nano-scale glass fibre reinforcement) and in 84% (21 of 25 specimens) in Group C (QuiXfill placed on everStick). (Graph 1) These data differences were statistically significant (Fishers Exact Test, p < 0.05)

Fennis et al found that composite resin restorations placed on bi-directional fibre netting fractured in a favourable (restorable) way in 62% of specimens.$^{47}$ In comparison, when composite resin restorations were placed on a uni-directional fibre sub-structure 77% specimens fractured in a favourable manner (restorable). Studies by Akman et al, 2011 and by Lammi et al 2011 also showed that if a multi-directional substructure were used, 66% -80% of fractures were favourable (restorable)$^{47-49,50}$

The composite resin reinforced with nano-scale glass fibre reinforcement (Group B – Aelite) fractured in 28% of cases (7 out of 25) in such a manner that pulp tissue was exposed. (Photos 1 and 1a). This was the only group in this study in which pulp-exposing fractures occurred. These catastrophic type of fractures have also been reported to occur when conventionally-filled composite resin was placed on a substructure of short multi-directional fibre composite. $^{35}$
According to the literature\textsuperscript{35,36,42} some researchers also use a broad classification system based on the type of fracture, being either cohesive or adhesive. (Photos 2 and 2a). A more detailed investigation of fracture patterns in the current study (Graph 2) show that in Group A, the fractures were more or less evenly distributed between cohesive and adhesive types (Graph 2). 52% or 13 out of 25 specimens were cohesive fractures (Photo 3 and 3a). This differs from the finding of Taha (2011)\textsuperscript{51} who found mainly adhesive fractures. In Group B most of the fractures were cohesive (68%, 17 out of 25 specimens), while in Group C 76% (19 out of 25) of fractures were cohesive, and 16% (4 out of 25 specimens) of fractures were adhesive. This is similar to the finding of Tezvargil (2005).\textsuperscript{49} In all 76% of cohesive failures the fracture occurred between the fibre substructure and the composite resin as illustrated in Photo’s 4 and 4 (a).

The superior performance of Group C seems to support the hypothesis that the fibre substructure acts as a crack-deflecting mechanism, enabling the composite resin restoration to endure significantly higher forces before fracture.\textsuperscript{18-20,23} It is speculated that the absence of a uni-directional fibre substructure might be the reason for the fractures that occurred in Group B in such a manner that the pulp was exposed. This speculation is supported by a recent publication by Fräter et al, 2014.\textsuperscript{23}

CONCLUSION

Analysis of fracture patterns in this study identify statistically significant differences between the three restoration groups studied. The conventionally-filled composite placed on a uni-directional fibre substructure showed the most favourable (restorable) fracture pattern; with the composite restoration incorporating nano-scale glass-fillers showing the least favourable fracture pattern.

It can therefore be concluded that placing a fibre substructure underneath a conventionally filled composite restoration will enhance the ‘restorability’ of the fracture pattern and ultimately may thereby extend the life-span of the restored tooth.

Declaration: Dr HJ Visser is the co-owner of a Dental Company (Stick Bond Dental CC) which imports one of the key products.

References

Dental Caries status in six-year-old children at Health Promoting Schools in KwaZulu-Natal, South Africa

M Reddy1, S Singh2

ABSTRACT

The 2003 National Children’s Oral Health Survey indicated that 35.2% of six-year-olds in KwaZulu-Natal were caries free and only 40% had received dental treatment. The aim of the present study almost ten years later was to investigate these data in six-year-old children at Health Promoting Schools in KwaZulu-Natal.

Methods: A quantitative, epidemiological explorative study was conducted on a sample of 345 Grade 1 learners attending 23 schools, selected by statistical sampling from the eleven districts of KwaZulu-Natal. The World Health Organisation DMFT Tool (1994) was used to record the data.

Results: The caries rate of the sample was 73% (ie. 27% caries free) and the mean dmft was 3.65. The average dmft per school ranged from a high of 6.8 to a low of 1.1, both from rural districts. 94% of the learners required treatment, the majority (90%) needing preventive care. The Unmet Treatment Need (UTN) was 97%.

Conclusions: The number of caries free six year old children in KwaZulu-Natal has declined further compared with ten years ago. Dental caries is still a major public health problem. An effective and efficient oral health promotion programme will do much to instil simple healthy behaviours at an early age.

Keywords: dental caries prevalence, health promoting schools, oral health promotion, oral health services, treatment needs.

INTRODUCTION

Three national studies have been conducted in South Africa. The first by Williams in 1984 was on dental health status of 12-year-olds.1 The second study determined oral health status of adults and children in the five main cities in South Africa in 1988/89, and the third study in July 1999 to June 2002 focused on children between the ages of 4 and 15 years.2,3 The latter two studies were conducted by the National Department of Health.

The National Children’s Oral Health Survey (2003) indicated that only 35.2% of six-year-olds were caries free in KwaZulu-Natal and 40% received dental treatment.2 A comparison of results for six-year-olds in the Durban region for both of the Department of Health National surveys indicated that there was a decrease in mean dmft from 3.89 (1988) to 3.42 (2002) and decayed teeth from 3.58 (1988) to 2.79 (2002) with no difference in results for the number of filled teeth (0.15).2,3 One of the new National Goals for six-year-olds for 2020 is to increase the percentage of this age group who are caries free to 60% in addition to having fissure sealants placed in 60% of these children.4

Dental caries is influenced by multiple factors such as diet, socio-economic status and the availability of oral health services. The affliction has been identified as the most widespread condition affecting children in South Africa. The inevitable dental pain and discomfort result in the loss of school days and dental caries has become a major public health concern because of the burden it places on public health services.4,5 Evidence in the literature suggests that intervention strategies that are currently employed are standardised and not evidence-based for diverse populations. These interventions are therefore not producing the desired outcomes resulting in the failure of the current National Oral Health plans in South Africa.1 Consequently, the prevalence of caries in children has not been adequately addressed through policy and service delivery.6

There is a paucity of information available on dental caries status in KwaZulu-Natal, South Africa, particularly in the rural areas where the majority of the population live.7,8 The last National Oral Health Survey, conducted ten years ago,
established that there was an increasing rate in caries in six-year-olds especially in the primary dentition. The school setting, where education and health programmes can have a great impact by influencing learners at important stages in their lives – childhood and adolescent, was chosen for this study.\(^4\) The purpose was to assess the dental caries status of a sample of six-year-old learners at health promoting schools in KwaZulu-Natal and to establish new baseline information prior to the implementation of an oral health promotion programme at these schools.

**METHOD**

The study sample (n=345) comprised of Grade 1 learners attending 23 schools that were selected from the eleven districts of KwaZulu-Natal using multistage cluster sampling. Schools were selected according to districts and then quintiles. Using a sample size calculator, a power calculation was done with a confidence level of 95% and a confidence interval of 5, selecting 345 learners for caries assessment from a total of 2402 Grade 1 learners, a selection that translated to an average of 15 learners per school. Systematic random sampling was used to identify participants by randomly selecting learners from approved parental consent forms that were provided to each school. The reporting of the status of the tooth focused on primary teeth, given the age group that was examined, and given the presence of only a few permanent teeth. However permanent teeth were included for the assessment of treatment needs, to report on caries arrest and sealant care for this age group.

This was an epidemiological explorative study using quantitative data. The World Health Organisation DMFT Tool (1994) was used to record the data.

Gatekeeper permission was obtained from the Department of Education and the principals of the selected schools. The study was approved by the Humanities and Social Sciences Research Ethics Committee of the University of KwaZulu-Natal (HSS/0509/013D) and ethical guidelines was used to ensure confidentiality in the management of data.

An information sheet and parental consent forms in English and Zulu were sent to all parents of Grade 1 learners at selected schools requesting consent for dental examination. Assent was obtained from the learners prior to the examination. Examinations were conducted only on learners who were willing and whose parents had granted consent. Field assistants were calibrated for visual dental caries diagnosis using the method developed by the British Association for the Study of Community Dentistry (BASCD) with intraoral photographs to a kappa score of 0.90 for inter examiner reliability.\(^10\) Intra examiner reliability was maintained according to World Health Organisation standards for oral health surveys by repeating every fifth oral examination completed.\(^11\) A tooth was recorded as decayed only if there was a visible break in enamel and missing teeth were scored only if it could be ascertained that the loss was due to caries. There was no treatment score for arrested decay with no pain on deciduous teeth.

Non-invasive oral examinations, using only a wooden spatula for retraction, were performed on learners sitting on a chair in good natural light with their heads slightly tilted, either forwards or backwards, and the examiner seated in front. Optimal infection control procedures were maintained by using new spatulas and gloves for each patient and having the examiner wear a mask. Learners requiring further dental management were referred to the nearest dental clinic.

Data was recorded on the World Health Organisation DMFT tool and transferred onto Excel. The statistical package used for data analysis was SPSS version 21.0.

**RESULTS**

The sample of Grade 1 learners (n=345) had a ratio of males to females of approximately 1:1 (51.6%;48.4%). The mean age of the participants was 6.8 years with 96.7% in the six to eight year old age group. Fourteen (60.9%) of the schools were in rural areas, six (26.1%) in the peri-urban and three (13%) in urban areas.

The Pearson Chi Square Test showed no significant differences in the results of the repeated tests for intra examiner reliability, confirming repeatability.

Of the total study sample (345) of learners, 130 (37.7%) male learners presented with caries compared with 114 (33.0%) female learners. The Fischer’s Exact Test (p-value 0.196) implied that there was no significant relationship between gender and the number of decayed teeth. The prevalence of caries between the rural and the urban learners also showed no significant difference.

The caries experiences of primary teeth of six-year-olds are shown in Table 1.

<table>
<thead>
<tr>
<th>Table 1: Caries experiences of the primary teeth of the six-year-olds in a KwaZulu-Natal sample.</th>
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</thead>
<tbody>
<tr>
<td>Primary</td>
</tr>
<tr>
<td>Mean no. of primary teeth per person</td>
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<tr>
<td>No. and percentage of subjects with caries</td>
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<tr>
<td>Mean number of decayed primary teeth per person</td>
</tr>
<tr>
<td>No. of missing primary teeth</td>
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<tr>
<td>Percentage of missing primary teeth per person</td>
</tr>
<tr>
<td>No. of filled primary teeth</td>
</tr>
<tr>
<td>Percentage of filled primary teeth from total number of teeth examined (n=7617)</td>
</tr>
</tbody>
</table>

The mean number of primary teeth and the mean number of decayed primary teeth per person was 14.98 and 3.13 respectively. The percentage of subjects with caries in the primary dentition was 73%. Only 0.11% of total number of primary teeth examined was filled and the percentage of missing primary teeth per person was 2.54%.

Table 2 shows a distribution of the components of dmft with low missing (0.5) and filled (0.02) components and a mean dmft of 3.65.

<table>
<thead>
<tr>
<th>Table 2: Distribution of the mean dmft and the components of dmft for the six-year-old age group</th>
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<tr>
<td>dmft</td>
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<tr>
<td>3.65</td>
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The severity of dental caries expressed as the mean dmft for schools and percentage dmft per child and district in KwaZulu-Natal are shown in Table 3.

The mean dmft scores for the districts ranged from a low of 1.9 (Umkhanyakude) to a high of 5.7 (Amajuba).
The d component of the dmft made up more than 85% of the total mean. The mean range dmft for schools was 1.1 (Mashesheleng, Umzinyati District) to 6.8 (Cebelihle, Amajuba District) which are both located in rural areas.

The percentage dmft per child ranged from a low of 4 (Mashesheleng, Umzinyati District and Ezimbidleni, Umkhanyakude District) to a high of 21 (Cebelihle, Amajuba District). This translated to 96% of the children having a dmft of 0 in the Umzinyati and Umkhanyakude districts, both rural areas. The percentage dmft per district ranged from a low of 6 (Umzinyati and Umkhanyakude) to a high of 18 (Amajuba). This meant that 94% of the children were caries free in the Umzinyati and Umkhanyakude districts, but only 82% in Amajuba.

Of the total sample only eight teeth had fillings recorded with seven from Bay Primary in the Uthungulu district. Seven fillings were present in one child. There were a higher number of posterior lower teeth missing due to caries compared with upper teeth.

The number of carious primary teeth by school and district in KwaZulu-Natal are shown in Table 4. The percentage of decayed teeth varied widely for schools and districts with scores of 6 to 33.7 and 8.7 to 27.5 respectively. Umkhanyakude district, which had the lowest scores and Amajuba the highest are both rural areas.

The number of carious upper and lower primary anterior (incisors and canines) and posterior (first and second molars) primary teeth for the study sample are illustrated in Table 5. The lower molar teeth suffered a higher incidence of caries present compared with the upper molars (508 vs 331).

| Table 3: dmft per school and percentage dmft per child and district in KwaZulu-Natal |
|---------------------------------|--------------------------------|-----------------|-----------------|
| District          | School      | *Rural/Peri-urban/urban R/PU/U | Average dmft District/School | % dmft per child | % dmft per District |
| Amajuba           | Cebelihle P | R                             | 5.7                          | 6.8              | 21               | 18               |
|                   | Clavis P    | R                             | 4.7                          |                  | 15               |                  |
| eThekweni         | Greenbury P | PU                            | 4.6                          |                  |                  |                  |
|                   | Zakhele P  | PU                            | 4.4                          |                  | 14               |                  |
| Sisonke           | Ixopo P     | R                             | 4.0                          | 4.1              | 13               | 13               |
|                   | Mazongo P   | R                             |                              | 3.9              | 12               |                  |
| Ugu               | Mdlazi P    | R                             |                              | 2.8              | 9                | 10               |
|                   | Port Shepstone P | PU       |                              |                  |                  |                  |
|                   | Port Shepstone JP | PU  |                              |                  |                  |                  |
| Umgungundlovu     | Fairleigh P | R                             | 4.4                          | 3.9              | 12               | 14               |
|                   | TPA P       | U                             |                              |                  |                  |                  |
| Umkhanyakude      | Echwebeni P | R                             | 1.9                          | 2.6              | 8                | 6                |
|                   | Ezimbidleni P | R                      |                              |                  | 1.2              | 4                |
| Umzinyati         | Endumeni P  | PU                            | 2.9                          | 4.7              | 15               | 9                |
|                   | Mashesheleg P | R                      |                              |                  | 1.1              | 4                |
| Uthukela          | MLS Colenso P | PU                 | 4.3                          | 4.3              | 13               | 14               |
|                   | MLS Ladysmith P | U                      |                              |                  |                  |                  |
| Uthungulu         | Bay P       | PU                            | 2.7                          | 3.3              | 10               | 8                |
|                   | Phalane P   | R                             |                              | 2.1              |                  |                  |
| Zululand          | Thengisangaye P | R                      |                              | 3.5              | 11               | 10               |
|                   | Velankosi P | R                             |                              | 2.7              | 8                |                  |
| iLembe            | Nokubusa P  | R                             |                              | 3.5              | 11               | 11               |
|                   | Nophungwa P | R                             |                              | 3.4              |                   |                  |

*A peri-urban area is classified as an area immediately around an urban area and a rural area is found outside the cities and towns.*
The findings for the anterior teeth were the opposite with a higher number of carious lesions present in the upper teeth. Higher caries scores were found predominantly in the rural areas.

Table 6 shows the treatment needs of learners.

From the total sample (n=345), 94% (324) of the learners required some form of treatment. Ninety percent (90%) of the learners required preventive care, 35%, surface fillings and 5%, extractions. Learners at Sisonke, Ethekweni and Ugu districts required more fillings compared with learners in the Umgungundlovu and Ilembe districts.

The mean number of teeth requiring treatment per child was 4.3. Fissure sealants were required on 16.4% of the secondary (first permanent molar) teeth examined; while 4.6% and 0.5% (primary and secondary) teeth required fillings and extractions respectively.

DISCUSSION

The current data may not be a good indicator of the impact of caries in South Africa. A small number of epidemiological studies have been conducted in KwaZulu-Natal, especially in the rural areas. This has resulted in limited information on dental caries status being available to inform planned oral health interventions that is based on the needs of the population. There have been few or no studies which have considered etiological factors, parental education and social factors that include various population groups and social classes. Similar findings have been found in studies done elsewhere in Africa where various diagnostic methods were used and there was a variation in the age groups assessed.

Of significance in dental caries epidemiological studies are the methods used for population sampling. South Africa has a diverse population with various social groups as well as populations living in different geographic locations namely urban, peri-urban and rural areas. It is therefore imperative...
that consideration be given to geographic distribution and to the methods used for population sampling prior to the planning of intervention strategies for dental caries. These data would inform policy planning and service delivery so that policies are tailored to meet the oral health needs of the various communities especially at district level.6,13

This study therefore drew a sample which included all eleven districts of KwaZulu-Natal. Any programmes to be implemented in response to the oral health needs of six-year-olds in the Province should then be informed by the data collected, which could be used as a baseline for other studies.

It is recognised that the permanent teeth were present for only a short period of time in the age group examined and were therefore not exposed to caries risk factors for any length of time.

The results from this study were compared with the KwaZulu-Natal results from the two National Oral Surveys conducted in South Africa as shown in Table 7.

The Unmet Treatment Need Index (UTN) was used to calculate the amount of oral health services needed to be provided for treatment of caries in the six-year-old age group. The UTN was 97% which translates to more than 90% of all caries in this group remaining untreated in KwaZulu-Natal. Comparison of the results obtained in the Durban area to the National Oral Health Surveys (Table 7) showed an increase in the decayed (d) component and a decrease in the filling (f) component. The increase in the d component could be as a result of a change in diet in this area. The decrease in f component could be as a result of extractions being the only option offered at primary health care centres.56

Results from this study showed an increase in prevalence of caries for six-year-olds in KwaZulu-Natal when compared with the results obtained in the last National Oral Health Survey (2003) (Table 7). Evidence also shows only that one district (Umkhanyakude) from the eleven districts had a low dmft score (1.9) (Table 3) indicating that dental caries has not been adequately addressed and that there remains a need for an improvement of oral health services in KwaZulu-Natal. When the data was further analysed it was clear that there was an increase in the d and m components and a decrease in the f component of the dmft with the latter indicating a possible decrease in the provision of restorative procedures in oral health services. The literature states that in KwaZulu-Natal the focus is currently on curative (extractions) rather than preventive services with a priority not given to oral health in budget allocations.7,18

Results from this study have further identified that the percentages of caries amongst the rural sample varied considerably when compared with the experiences in the urban and peri-urban areas. There were also wide differences in the mean dmft per school and in the percentage dmft per child and per district for primary teeth. Although schools from the urban areas had high dmft scores (4.4; 4.9), they were not as high as in some of the rural areas (5.7) (Table 3). These results differed from studies done in other provinces in South Africa where rural scores were all lower than those in urban and peri-urban areas.19-20 A study conducted in Portugal showed the opposite trend with caries scores significantly higher in rural areas.21 The higher scores in the rural areas in the current study could be due to incorrect diet, source of water and fluoride content, lack of knowledge on oral health education, poor access to oral health care, and affordability of fluoridated toothpaste.22 More research should be done to establish the risk factors for caries and the reasons for the swings in high and low scores in rural areas.

Primary teeth in the rural and urban areas were found to have no restorations but there was evidence of a minimal amount of conservative work on children in the peri-urban areas with the majority from a school in the Uthungulu district. Similar results were obtained in a study undertaken in Venda.18 Overall it appears that scarce curative services are delivered. This could be as a result of a scarcity of oral health personnel, limited resources, lack of accessibility to facilities and affordability. Priority needs to be given to six-year-olds for curative and preventive services.

Most relevant was the confirmation that the percentage of learners requiring treatment was very high (94%) (Table 5). The most common type of care needed was preventive services (fissure sealants). The need for prevention and restorations was higher than the need for extractions. This could be as a result of the criteria used where teeth that were decayed with no pain and could not be restored were nevertheless not indicated for extraction. Reasons for these high scores could include affordability and a lack of availability and accessibility to oral health services, especially in rural areas. The type of services required varied between districts. All districts required preventive services. The majority of restorations required came from the Sisonke, eThekweni and Ugu districts. For these services to be provided relevant oral health personnel, facilities, equipment and materials would have to be accessible.

Only 27% of the sample six-year-old age group in KwaZulu-Natal are caries free. More than 90% of caries goes untreated. If the criteria for the new National Health Goals for 2020, which state that 60% of 6-year-olds must be caries free and have fissure sealants placed on their first molars in Grade 1 learners requiring treatment was very high (94%) (Table 5). The most common type of care needed was preventive services (fissure sealants). The need for prevention and restorations was higher than the need for extractions. This could be as a result of the criteria used where teeth that were decayed with no pain and could not be restored were nevertheless not indicated for extraction. Reasons for these high scores could include affordability and a lack of availability and accessibility to oral health services, especially in rural areas. The type of services required varied between districts. All districts required preventive services. The majority of restorations required came from the Sisonke, eThekweni and Ugu districts. For these services to be provided relevant oral health personnel, facilities, equipment and materials would have to be accessible.

| Table 7: Comparison between data from NOHS 1988, 1999-2002 and that from current study of prevalence of dental caries and untreated caries in six-year-olds in KwaZulu-Natal |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| % caries KZN | % untreated caries KZN | % children need care KZN | dmft Durban | d (Durban) | f (Durban) |
| 1988 | 64.8 | 59.9 | 62.3 | 3.89 | 3.58 | 0.15 |
| 1999 – 2002 | 73% | 71% | 93.9 | 4.55 | 3.1 | 0 |

services by employing oral health personnel such as oral hygienists and dental therapists and ensuring that the focus of services provided at clinics should include restorative care for the treatment of caries.

Results from a previous study conducted in Hlabisa in 2002 were also compared with results from the Umkhanyakude district in this study, to which Hlabisa belongs.23 The dmft for the Umkhanyakude district was 6 in this study, which was double the score for Hlabisa (3). The increase in dmft could be as a result of an increase in per capita sugar consumption together with a decrease in water fluoride levels.24 There was a slight difference in the number of fissure sealants required per learner in both studies but there was a huge difference in the number of learners requiring restorations. In this study only 8 learners required restorations compared with 95 in the Hlabisa study. This large difference could be due to the differing criteria used for caries diagnosis in the deciduous teeth.

This study has revealed a high caries prevalence in the six-year-old age group in KwaZulu-Natal highlighting the need for a change in approach to the control of this disease. Taking into consideration the difference in availability of oral health services in the various districts and the fact that it will take a long time for this issue to be addressed due to limited funding, the school setting could provide an affordable platform for oral health promotion programmes based on the needs of the community at a local level. Data provided in this study reflects what is currently in place in KwaZulu-Natal and can be used as a basis for future planning of preventive programmes targeting primary school children.

CONCLUSION

The number of caries-free six year old children in KwaZulu-Natal has declined further compared with ten years ago. Dental caries is still a major public health problem and most children require some type of treatment including preventive care. Current oral health services need to shift from a curative to a more preventive approach for an improvement in service delivery. An effective and efficient oral health promotion programme at schools, targeting both parents and young children will do much to instil simple but beneficial oral health behaviours at an early age. It will take a long time to bridge the gap currently present, but making available basic information to learners and parents for the prevention of caries would be a good start.

Acknowledgements

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REFERENCES

Comparison of colour differences in visual versus spectrophotometric shade matching

ABSTRACT

Introduction: The challenge of achieving accurate colour matching in restorative dentistry is central to success in aesthetics. For many years selection of tooth colour in both restorative and prosthodontic dentistry have relied on shade guides which present a number of tabs of differing hue. Signal difficulties do arise with their use, notably in terms of accuracy and variability under differing circumstances. The use of a digital device to evaluate and record tooth colour offers an advanced option.

Aim: There is merit in assessing the extent of agreement between the digital and the human assessment methods.

Method: Twenty five patients were selected who had all upper anterior teeth, with the right central being pristine. Colour assessments were undertaken using a variety of guides and devices. The measurements were recorded and subjected to statistical comparisons.

Results: In general there were significant differences recorded between the systems but it appears that these results may not be of clinical import.

Conclusions: The advice to practitioners is that it would be best practice to use both human assessment and digital evaluation to ensure that acceptable aesthetics are achieved.

INTRODUCTION

Colour matching remains one of the most challenging tasks in clinical dentistry. The ability of a dentist to select and communicate an acceptable shade match is an important factor for the success of treatment especially in meeting patient expectations and demands for accuracy in aesthetic dentistry.1,2

Traditionally, shade matching of teeth in dentistry is done by visually comparing the colour of tooth/teeth with standard shade guide tabs, the operator choosing that which he/she deems to be the best or closest match. These shade guides offer relatively quick and cost effective methods of shade matching, offset by the major problems of the subjective variability of shade matching, the polychromatic nature of teeth, and the limitations of dental shade guides that incompletely represent the colour range of natural teeth.3 The inconsistencies between commercially available shade guides and actual tooth shades are influenced by the variety of materials used to fabricate these guides.4

Differences in perception of colour (operator subjectivity), operator experience,5,6 fatigue and colour blindness are human physiological factors affecting visual tooth matching. Colours appear different when viewed under varying light sources, which may have different colour distribution. This phenomenon is known as metamerism and may result in perceptible and unacceptable colour differences in changing settings.7 Thus, ambient light has to be standardised before tooth colour is assessed, to minimise the influence of variables such as the light source, time of day, the surrounding background colour of the walls and the angle and distance at which the tooth is viewed by the operator.8

Recently, various clinical colour-measuring devices have become available. These are efficacious in quantifying the natural tooth colour and also enable communication between technicians and dentists to be more uniform and accurate.9 A number of colour-measuring instruments are commercially available such as ShadeVision (X-Rite, Grand Rapids, MI, USA), which is a colorimeter; Easyshade (Vita Zahnfabrik, Bad Sackingen, Germany), which is a spectrophotometer that does not provide images; and SpectroShade Micro (MHT, Verona, Italy) and Crystal-eye, which are spectrophotometers that also provide images.2 The advantages of a digital shade-matching system include objective readings and accuracy. The spectrophotometer can be used consistently to accurately measure the natural tooth colour in reference to a known colour, and it can be used based on the settings of other shade matching systems. It evaluates the colour characteristics of the tooth by measuring the different light intensities in various parts of the tooth/colour distribution. These data are then transmitted to software which maps the different shades on a digitised tooth. In this way, the instrument develops an accurate interpretation of the tooth shade on a given colour system, which can then be related to an existing dental shade tab or to a colour that is interpolated between the shade tabs.
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Several studies\textsuperscript{21,22,24} have shown differences between visual shade-matching guides and digital devices for shade matching but few\textsuperscript{10,31} have looked at the clinical implications. Currently, very few studies have quantitatively assessed the errors or differences arising from visual shade matching using shade guides in vivo to determine colour of teeth. The aim of this study was to evaluate and compare the differences in colour selection between visual shade-taking using Vita Classical and Vita 3D Master (VITA Zahnfabrik GmbH, Germany) shade guides and the data recorded by a spectrophotometer (SpectroShade MHT, Verona, Italy).

**MATERIALS AND METHODS**

Twenty five patients aged between 20 and 25 years were randomly selected. The inclusion criteria for patients were a complete set of anterior teeth and a sound upper right central incisor (tooth number 11). The exclusion criteria for patients were non-vital teeth, presence of crowns or veneers related to the tooth to be matched, smokers, patients with poor oral hygiene, presence of any enamel or dentinal defects, patients that have previously undergone whitening procedures and patients that were using any form of orthodontic appliance at the time of the shade determination.

All patients were seated in a dental chair set in the upright position with the patient’s head firmly positioned in the headrest, in a room with grey walls and ceiling-mounted D65 daylight-corrected fluorescent lighting (K6500). Prior to shade matching the tooth surface was cleaned by asking the patient to brush the front teeth for one minute and then rinsing. The teeth were then thoroughly drenched with water spray to avoid a false reading due to extrinsic discolouration. The tooth surface was wiped with moistened gauze immediately prior to taking the reading. Care had also been taken not to dehydrate the teeth prior to colour measurements to avoid changes in opacity, which may occur as a result of intrinsic loss of humidity.

**Spectrophotometer measurements**

A reflectance spectrophotometer (SpectroShade, Handy Dental Type 71.3000, Serial No. HDL2173, MHT, Verona, Italy) was used in this study. For the first shade matching reference point the spectrophotometer (Figure 1) was set on Vita Classical. As per the instructions of the manufacturer a calibration of the spectrophotometer was performed before each reading was taken using a white and green ceramic block provided by the manufacturer.

The device was set on full tooth mode and was placed perpendicular to the tooth surface of the maxillary right central incisor (Figure 2), flush on the area between the middle third of the crown and the incisal edge as indicated by the cross lines seen on the image of the tooth on the device. The instrument was hand-held steadily against the tooth surface and the activation button on the hand piece was pressed until the machine beeped to indicate completion of the measurement and the result shown on the screen of the device. A reading was obtained only when the tooth was in full focus and an outer green line completely encircled the image of the tooth (Figure 3). These precautions enabled accurate and reproducible readings. Each reading was repeated several times by one examiner until two identical and sequential readings were achieved. That data was taken as the reference for the tooth in the Vita Classical Shade.

For the second shade matching reference reading, the spectrophotometer (SpectroShade MHT, Verona, Italy) was set on Vita 3D Master Shade and the colour matching procedure was then repeated for each patient.

Both the Vita Classical and Vita 3D Master readings were then converted to the $L^\ast a^\ast b^\ast$ scale using the SpectroShade software (SpectroShade MHT, Verona, Italy).

The third set of reference readings were obtained when the spectrophotometer was set on $L^\ast a^\ast b^\ast$ colour system to obtain an objective (actual) colour of the tooth and the colour matching procedure was repeated for each patient.

**Tooth colour determination by shade tab selection**

The colour of the test teeth were also matched using two shade guide systems, Vita Classical (16 shade tabs) and Vita 3D Master with 26 shade tabs Two experienced...
male operators (each with about 25 years clinical experience), independently recorded the colour of the maxillary right central incisor under the same conditions as for the spectrophotometer. Prior to this study, both operators had taken an online colour test (X-rite Pantone Test based on the Farnsworth Munsell 100 Hue Test) and had shown high accuracy for visually assessing shade.

Validation of L*a*b* colour measurements

To validate the repeatability of the spectrophotometric analysis of L*a*b* data of the upper central incisor, separate measurements of the shade tabs of both the Vita Classic and Vita 3D Master were taken with the device. Mean colour differences (ΔE*a*b*) between the shade tab data and the spectrophotometer readings were then analysed using the Commission Internationale de l’Eclairage colour coordinates and described using the following calculations:

1. $ΔL^* = L_2^* - L_1^*$
   - $L^*$: lightness-brightness difference in lightness/darkness value $+$ = lighter and $-$ = darker
2. $Δa^* = a_2^* - a_1^*$
   - $a^*$: green-red difference on red/green axis $+$ = redder and $-$ = greener
3. $Δb^* = b_2^* - b_1^*$
   - $b^*$: yellow-blue difference on yellow/blue axis $+$ = yellower and $-$ = bluer
4. $ΔE^{(a*b*)} = \sqrt{(ΔL^*)^2 + (Δa^*)^2 + (Δb^*)^2}$ (total colour difference value)

STATISTICAL ANALYSES

The level of agreement for shade-matching techniques were determined using the Pearson’s Correlation Coefficient using IBM SPSS ver21 statistics program (SPSS Inc., Chicago IL, USA). Multiple comparisons between the groups were analysed using the Wilcoxon Signed Rank Test. All non-parametric statistical analyses were performed at a 95% confidence interval (CI) with the level of probability set at alpha = 0.05.

RESULTS

Figures 3 and 4 show the relationship of the data between operators 1 and 2 compared with those of the spectrophotometer set on the Vita Classical scale. The yellow band shows the number of teeth whose readings were in agreement between the operators and the spectrophotometer. The data of 17 teeth were in agreement between operator 1 and the spectrophotometer while a total of eight teeth (four above and four below the yellow band) showed disagreements (Figure 3). Operator 2 was in agreement with the spectrophotometer 15 times (Figure 4) and showed a difference on 10 readings (five above and five below the yellow band of agreement).

When using the Vita 3D Master shade guide, operator 1 was in agreement in four instances and out of agreement 21 times with the spectrophotometer (Figure 5) while operator 2 was in agreement nine instances and out of agreement with the spectrophotometer 16 times (Figure 6).

When the colour differences between the actual colour of the tooth and the readings of the operators in the L*a*b* scale were compared there was no significant difference between the data of the operators in both the shade guide systems (Wilcoxon Signed Rank Test, p>0.05). There was a significant difference, however, between the colour differences between the visual shade guides and the spectrophotometer (Wilcoxon Signed Rank Test, p<0.05). The mean CIE L*a*b* colour difference (ΔE*a*b*) between the actual colour of the tooth in Vita Classical and the shade selected by the spectrophotometer, and by operator 1 and by operator 2 were 2.22(SD±0.65), 2.78(SD±1.08) and 2.8(SD±1.01) respectively, while the colour differences in the Vita 3D Master system were 2.18(SD±0.65), 3.39(SD±1.26) and 3.30(SD±1.28) for the spectrophotometer, operator 1 and operator 2 respectively (Table 1).

Table 1: Mean CIE L*a*b* color differences, ΔE*a*b* with standard deviation between the actual color of the tooth and the selected shade of the spectrophotometer, operator 1 and operator 2 in Vita Classical and Vita 3D Master.

<table>
<thead>
<tr>
<th></th>
<th>SpectroShade</th>
<th>Operator 1</th>
<th>Operator 2</th>
<th>SpectroShade</th>
<th>Operator 1</th>
<th>Operator 2</th>
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<tr>
<td>Vita Classical</td>
<td></td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>SpectroShadeVC</td>
<td>1</td>
<td>0.394</td>
<td>0.322</td>
<td>0.397</td>
<td>0.105</td>
<td>-0.038</td>
</tr>
<tr>
<td>Operator 1</td>
<td>0.394</td>
<td>1</td>
<td>0.633</td>
<td>-0.008</td>
<td>0.183</td>
<td>0.292</td>
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<tr>
<td>Operator 2</td>
<td>0.322</td>
<td>0.633</td>
<td>1</td>
<td>0.289</td>
<td>0.433</td>
<td>0.222</td>
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<tr>
<td>Vita 3D Master</td>
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<tr>
<td>SpectroShade3D</td>
<td>0.397</td>
<td>-0.008</td>
<td>0.289</td>
<td>1</td>
<td>0.540</td>
<td>0.236</td>
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<tr>
<td>Operator 1</td>
<td>0.105</td>
<td>0.183</td>
<td>0.433</td>
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<td>Operator 2</td>
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Table 2: Pearson’s Correlation matrix of color difference (ΔE*a*b*) units between Operator 1, Operator 2 and Spectrophotometer in Vita Classical (VC) and 3D Master shade guides.

<table>
<thead>
<tr>
<th></th>
<th>SpectroShade</th>
<th>Operator 1</th>
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<th>SpectroShade</th>
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<tr>
<td>Vita Classical</td>
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<tr>
<td>SpectroShadeVC</td>
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<td>Operator 2</td>
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<td>Vita 3D Master</td>
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Both operators were in agreement 64% of the time on the Vita Classical shade guide when compared with the spectrophotometer. There was a strong positive correlation in the colour differences (Table 2) between operator 1 and operator 2, both in the Vita Classical shade guide data (Pearson’s coefficient of correlation, r = 0.633) and in the Vita 3D Master shade guide data (Pearson’s coefficient of correlation, r = 0.649).

In L’*a’*b’ scale there was a strong negative correlation in the L’ and a’ for both Vita Classical (Pearson’s coefficient of correlation, r = -0.817) and Vita Master3D (Pearson’s coefficient of correlation, r = -0.852).

**DISCUSSION**

Colour matching of a natural maxillary central incisor, even under ideal conditions, is one of the most difficult challenges in clinical dentistry.2 Despite the fact that the inaccuracy and subjectivity of visual perception and the limitations of shade guides have been pointed out,2,12 the technique is still one of the primary methods of colour matching in dentistry.14,15 with the Vita Classical shade guide being the most popular.12

A colour-measuring device that produces constant values under any given condition would be most valuable.1 In this study the spectrophotometer was sequentially set on the Vita Classical, Vita 3D Master and L’*a’*b’ scales to compare those data with the results of the visual method of shade matching. The spectrophotometric reading is not affected by ambient light, and the amount of light reflected from objects is measured over a full spectral wavelength.2 A high level of agreement was observed in the use of spectrophotometers confirming their reliability for use as a shade matching device in dentistry.2,16,17 Most, including SpectroShade, had similar high reliabilities (over 96%), indicating predictable shade values from repeated measurements.18,19 However, widespread use of spectrophotometers in clinical settings is hampered by the fact that the equipment is complex and expensive and that it is difficult to measure the colour of teeth in vivo.20

In this study the colour matching in both visual colour methods as measured by the operators using both the Vita Classic and Vita 3D Master systems differed from the spectrophotometer readings. Both operators were accurate 64% of the time when using the Vita Classical shade guide. Other studies showed inter-observer agreement in selecting the best shade match to be about 30% for both Vita Classical and Vita 3D Master.20,21 In a study by Paul et al.20 the human operators using Vita Classical shade tabs visually selected shades that were matched with shades measured by means of a reflectance spectrophotometer in only 26% of the tests.

In the Vita 3D Master shade scale data, a larger difference was noted between the human observers and the digital measurement, possibly as a result of the system having more adjacent tabs are not uniform,15,13 and the colour difference values between each pair of shade tabs in the Vita 3D Master shade guide study ranged between 0.9 and 18.6 ΔE units.25 Furthermore, coverage errors and ΔE values in all of the five shade guide systems tested were all beyond the clinical threshold of ΔE = 3.3 units.24 When considering 16 colours, there is a low agreement between visual assessment by the examiners and by the digital spectrophotometer, possibly explained by the predominance of shades of colour situated in the medium spectrum of the shade guide, impairing visual detection of small colour changes by the examiners.25 Examiners find difficulty in identifying exact colours or differentiating between colours immediately adjacent on the Vita Classical shade scale.25

For a more accurate and predictable aesthetic outcome it has been suggested that both instrumental and visual colour matching methods should be used, as they complement each other26 especially where there may be uncertainties from visual matching techniques.

In the current study the MHT SpectroShade was used as it can measure colour when set in the Vita Classical, Vita 3D Master or L’*a’*b’ scales. The SpectroShade measures the complete tooth surface area providing a colour map of the tooth that can then easily be communicated to laboratories. Other devices that measure a limited tooth surface area (3 to 5 mm) may suffer an edge loss of the light, which may result in errors in colour.27 Also, the light from the SpectroShade is splinted in order to have each tooth illuminated simultaneously from two sides at 45° angles and directed at 0° observation configuration (MHT Optic Research AG, Switzerland), which will avoid the inaccuracies of edge loss.28 Spectroshade was the most repeatable device in recording tooth shades clinically and showed a good proportion of complete agreement, higher than that achieved by X-Rite Shadevision colourimeter and Vita Easyshade spectrophotometer.29

Colour difference (ΔE’*a’*b’*) quantifies colour difference between any two objects, thus enabling a more precise understanding of the magnitude of the difference in colour. In this study, the mean colour difference (ΔE’*a’*b’*) of actual tooth colour (SpectroShade set in L’*a’*b’* scale) and the SpectroShade readings set in Vita Classical and Vita 3D Master of the corresponding tooth was 2.2, while the colour difference between the chosen shade tabs of Vita Classical for operators 1 and 2 and the actual colour of the corresponding tooth was 2.8 for both operators and 3.3 in the Vita 3D Master system. Paravina et al.30 have shown colour differences ranging between 2.4 and 5.2. When the differences they recorded between the best shade matching tabs were compared, the ΔE values ranged from 4.5 to 6.2,31 and are greater than those obtained in this study. ΔE’*a’*b’* values of tooth/shade tab values were found to be 7.61 for Vita Classical and 3.54 for Vita 3D Master.24

There is currently no consensus in the dental literature as to how much colour difference is considered an acceptable colour mismatch and how much of a colour difference is perceptible to the observer.1 Colour differences of ΔE’*a’*b’* = 1 were detectable by 50% of the observers in vitro,32 while Douglas and Brewer33 found 50% of the prosthodontists rejected a crown mismatch of ΔE’*a’*b’* = 1.7 in vitro. Douglas et al.34 showed a higher value of 2.6 ΔE units at which 50% observers could perceive a colour difference (perceptibility tolerance). A colour difference of 5.5 ΔE units was considered in that study as a mismatch in vivo but was clinically acceptable (acceptability tolerance). ΔE = 3.3 was considered unacceptable for 50% of observers when comparing composite resin specimens in vitro.34 A colour difference of ΔE = 3.7 units between teeth in the mouth was rated as a match, while ΔE = 6.8 as a mean colour difference was rated as a marginally acceptable mismatch between compared teeth under in vivo conditions.35
It is important to establish tolerances for both perceptibility and acceptability in terms of colour difference (ΔE units), as research results assessed for statistical significance alone cannot be interpreted for clinical significance. It may seem that a higher tolerance level may be acceptable in in vivo conditions.

Therefore, although differences were found in this study between the shade tabs chosen when using the Vita Classical and Vita 3D Master shade guides and the spectrophotometer readings, the actual colour differences may not be readily perceived and/or may be acceptable in the clinical situation. The strong negative correlation in the L* and a* for both Vita Classical (Pearson’s coefficient of correlation, r = -0.817) and Vita Master3D (Pearson’s coefficient of correlation, r = -0.852) indicates that as the error in L* increases the error in a* decreases. It may seem that errors in L* i.e. lightness/ brightness during shade matching may be an important factor in obtaining correct shade matching.

The Vita Classical shade guide was chosen for comparison because it has been a gold standard in dentistry for decades and is well established in the market, and the Vita 3D Master was supposed to more closely cover the tooth colour space. This study was designed to evaluate the accuracy of the visual shade matching technique and not to test the reliability of the spectrophotometer. A similar study design can be used to test the reliability of two or more spectrophotometers. This study evaluated each operator of the spectrophotometer separately for it seemed logical to test each operator individually rather than combining the readings as separating the data may give a broader descriptive analysis of any variability that may be present.

CONCLUSION

Within the limitations of this study, the results indicate that although visual assessment using shade guides to determine colour of natural teeth differed from that obtained using a spectrophotometer, the actual colour differences between the chosen visual shade matching tabs and the spectrophotometer fall within clinically acceptable limits.

CLINICAL SIGNIFICANCE

Whenever possible, both the instrumental and visual colour matching method should be used, as they complement each other especially where there may be colour measurement uncertainties from visual matching techniques and the combination can lead to a more predictable aesthetic outcome.

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The longevity of restorations - a literature review

ABSTRACT
Dentists need to consider various factors when choosing restorative materials, with the longevity of restorations being one of the most important criteria. Replacement of failed restorations constitutes over 60% of operative procedures, leading to high annual costs. This literature review compares the survival rates of different restorative materials used for both direct and indirect restorations. A literature search was carried out using Pubmed to identify all articles on restorative materials published from 1974 to 2014, of which 22 were included in this review. For direct restorations, amalgam showed the highest survival rates (22.5 years), with an average survival rate of 95% over 10 years, followed by composite resins (90% over 10 years), and glass ionomer cements (65% over 5 years). For indirect restorations, gold restorations are still the “gold standard” with a 96% over 10 years survival rate, followed by porcelain-fused-to-metal crowns (PFM) (90% over 10 years), and all ceramic crowns (75-80% over 10 years). Amongst the ceramic restorations, eMax shows the longest survival rate (90% over 10 years), and Zirconia the lowest (88% over five years). The longevity of restorations depends on many factors, including: materials used, type of restorative procedure, patient parameters, operator variables, and local factors.

INTRODUCTION
A wide variety of materials are used by dentists in the restoration of teeth. Many factors need to be considered by both the dentist and the patient when choosing the optimal restorative material for each procedure, with the longevity of that particular restorative material being one of the most important.1,2

Restoration success is the demonstrated ability of a restoration to perform as expected, whereas the length of time that a restoration survives (survival rate), is often used as a measure of clinical performance. Replacing failed restorations constitutes about 60% of all operative procedures carried out by dentists, with estimated annual costs of around $5 billion in the USA alone.1 Restorations have a limited lifespan and once a tooth is restored, a “restorative cycle” commences, where the restoration will likely be replaced many times throughout the lifetime of the patient.3 Dentists are obliged to inform their patients about the survival rates of different materials and restorative procedures. This will allow the patients to make informed decisions regarding their treatment options. The United States Public Health Service (USPHS) criteria have been used most widely to determine the clinical performance of restorations. This requires two independent examiners and uses a grading system based on a number of observations (eg. retention, colour match, secondary caries, etc.). For each observation there is a grading from Alpha (perfect), Bravo (less perfect), to Charlie (complete failure).1 The majority of the articles reviewed in this paper used these criteria in their evaluation, with the main focus being on survival rates.

DETERMINANTS OF RESTORATION LONGEVITY
A wide variety of both patient and clinician variables will influence the longevity of restorations.4 These include:

- Caries index, where a high index is often associated with a low restoration longevity, usually due to recurrent caries.5
- Restoration size, with larger restorations having greater failure rates due to their greater surface area, making them more susceptible to recurrent caries, fracture, and restoration failures.5
- Tooth position, with molars having lower restoration survival rates than anterior teeth.5 This relates to restorations being larger on posterior teeth and sustaining greater occlusal forces, affecting their longevity.
Clinician variables: more experienced clinicians have higher restoration survival rates.

Patient parameters may also play a role. Studies found that those who regularly change dentists had their restorations replaced more frequently, while restoration failures are highest among older patients and lowest in the 4-18 year age group. This may purely be due to older patients having older restorations, however, caries incidence is also higher in the elderly due to changes in their stomatognathic system, impaired motor function, and reduced salivary flow rates, amongst others.5

HOW LONG SHOULD RESTORATIONS LAST?

A literature search was undertaken using Pubmed in the identification of relevant articles published from 1974 up to and including 2014. The following keywords were used: longevity, restorations, prosthodontics, crowns, all ceramic, CAD/CAM, amalgam, composite, lifespan, survival. Twenty two articles have been included in this review, which covers both direct and indirect restorative materials as well as different manufacturing techniques.

DIRECT RESTORATIONS

Amalgam

This is still one of the most commonly used restorative materials in posterior teeth in some countries. It’s use is however declining due to higher aesthetic demands of patients and their concerns over mercury toxicity.6 It has a unique ability to seal itself over time by a phenomenon known as “creep”,7 which has been defined as “the deformation of a metal under a load that is below its proportional limit.”8 Dental amalgams have been shown to “creep” as a consequence of low-frequency cyclic stresses resulting from mastication and from thermal changes during ingestion of hot and cold food. The material expands with internal corrosion and phase changes, which will fill in the microscopic space at the tooth-amalgam interfaces. The median survival time of amalgam has been estimated to be 22.5 years,2 with some studies showing annual failure rates of 3%.4

Composite resin

Early composite resin materials showed failure rates as high as 50% after 10 years.2 This has drastically improved with the introduction of newer products. These materials can currently be classified as nanofilled, microfilled, or micro/nanohybrid materials with filler quantities varying from 42-55%. Of these, the hybrid composites performed the best with annual failure rates of 1.5-2%, most often as a result of restoration fracture.9 The major drawbacks of these materials are polymerization shrinkage and polymerization stress. These have the potential to initiate failure at the composite-tooth interface which will result in post-operative sensitivity and the opening of pre-existing enamel microcracks. Newer low stress flowable base materials can overcome some of these problems by reducing the amount of stress generated during polymerization (1.4 MPa compared with 4 MPa for other flowable composites).30 Such restorations should be followed up periodically for early detection of problems as once failures are initiated there is usually a rapid progression. The placement of glass ionomer cement liners under composites further improved their success rates and is now regarded as a “gold standard” procedure especially in posterior teeth. These cements resist caries formation in the adjacent tooth structure by maintaining the pH at levels above those required for demineralization to occur.11 Current approaches have seen the introduction of new nanocomposite materials which release fluoride (F⁻), calcium (Ca²⁺), and phosphate (PO₄) ions. These calcium and phosphate ions combine to form hydroxyapatite [Ca₁₀(PO₄)₆(OH)₂], thus strengthening the tooth and combating secondary caries.12 More studies and further development of these new materials is however needed.

GLASS IONOMER CEMENTS (GIC’S)

As mentioned, GIC’s make an excellent dentine replacement as a lining or base when managing dentinal caries but lack the physical properties needed to be used alone for posterior restorations.2 In addition, they are more readily lost interproximally where reduced saliva flow leads to sustained low pH levels. Improved saliva flow on other tooth surfaces helps restore the resting pH levels.11 These materials are most effective buffers in acidic environments and are also excellent luting agents. Their primary use is for restoring Class V cavities, primary teeth, and in the ART technique (atraumatic restorative treatment). In primary teeth GIC’s have a 93-98% survival (over the longevity span of the tooth), and a median survival of 30-42 months in permanent teeth. Their annual failure rate when used alone as a restorative material is estimated to be 7%.4

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15 CPD Points
INDIRECT RESTORATIONS

Gold crowns and inlays
These are considered the “gold standard” against which all other restorations are measured in terms of longevity. The most common biological reason for their failure is secondary caries, with retention loss being the most common technical cause of default. Studies have shown survival rates to range from 96% over 10 years, 87% over 20 years, to 74% over 30 years with a mean failure rate of 1.4% in the posterior permanent dentition.

Porcelain fused to metal (PFM) crowns
These restorations have been reported to have a 97% 10 year survival rate. The majority of failures (65%) occur in the anterior region (traumatic zone), and have been attributed to eccentric chewing forces, iatrogenic factors, accidents, and inadvertent contact with instruments during surgical operations.

ALL CERAMIC CROWNS

Many different types of materials are available for all-ceramic restorations. These can be chosen depending on the properties required for a particular clinical situation (such as aesthetic concerns versus the need for strength).

The lifetime of these materials depends on the presence of incidental cracks and their propagation under intra-oral conditions. There are substantial differences in material properties of the different ceramics, and thus they should be considered separately.

Heat pressed, reinforced ceramics
Leucite-reinforced (e.g. IPS Empress I) is reported to have a 99% survival rate after 3.5 years, and a 95% survival after 11 years, with better success reported for anterior restorations. The IPS EMax system is comprised of lithium disilicate ($\text{Li}_2\text{O}_2\text{SiO}_2$) glass ceramic and zirconium dioxide ($\text{ZrO}_2$) materials which are suitable for pressing, but can also be used with the CAD/CAM technologies. This is a highly durable, very strong (360-400MPa flexural strength) ceramic which can overcome some of the problems encountered with the chipping off of porcelain which is commonly encountered in zirconia restorations. Studies have shown their survival rates to be promising, with systematic reviews showing these to be in the region of 96% after five years.

Slip-cast glass-infiltrated ceramics
These include magnesium, alumina, and zirconia infiltrated variants, with some studies showing survival rates of 92-100% over five years for the magnesia and alumina variants.

Metal oxide ceramics
These materials usually contain alumina or zirconia which confer a toughness and superior fracture resistance but also inferior aesthetics due to the inherent opacity found in the high-density metal oxide crystals. Clinical studies have shown Procera Alumina crowns to have success rates of 98% over 5 years, and 94% over 10 years. Zirconia has been referred to as “ceramic steel” because of its superior material properties. It is a crystalline dioxide of zirconium, with mechanical properties similar to those of metals and a colour similar to that of teeth. Zirconia crystals are organized into three different patterns: monoclinic, cubic, and tetragonal. Zirconia ceramics used in dentistry are of the Yttrium-stabilized tetragonal type (YST), which offer excellent mechanical performance, strength, and fracture resistance. This is possible by the “phase transformation effect” that these materials undergo (tension induced tetragonal-to-monoclinic phase transformation). The net result is a volumetric expansion which compresses cracks to prevent propagation and enhances toughness to resist fractures. Cracking and crazing of the veneering porcelain is of major concern with some studies reporting this problem in as many as 50% of cases after only two years. This is the result of chewing forces being exerted on a very weak 90MPa feldspathic veneering porcelain, with the underlying 1000MPa zirconia substructure remaining intact, leading to ultimate failure of the restoration. Such chipping can also be attributed to rapid cooling protocols during fabrication when firing the veneering feldspathic porcelain onto the zirconia substructure. This can be overcome to some extent by ensuring slower cooling when the final restoration is removed from the furnace. These restorations have survival rates of 96% after two years, and 94% after four years, but longer term clinical studies are still needed.

CERAMIC INLAYS AND ONLAYS

IPS-Empress inlays and onlays have been shown to have survival rates of 96% after 4.5 years, and 91% after seven years. With the introduction of CAD/CAM systems into dentistry, in particular the CEREC (Chairside Economical Restoration of Esthetic Ceramics) system, clinicians are now able to use composite resin and ceramic materials to fabricate indirect restorations. The CEREC 1 system was mainly used for chairside fabrication of inlays and onlays with long-term studies showing adequate survival rates of 97% over five years, and 90% over 10 years. The main reasons for failure of these restorations were the result of ceramic fracture (feldspathic porcelain), followed by fractures to the underlying supporting tooth. With advances in technology, the CEREC 2 system was capable of producing inlays, onlays, full and partial crowns with survival rates of 87% over seven years. The current CEREC 3 system will manufacture veneers, short bridges, and implant abutments, with survival rates for these being 95-97% over five years.

FIXED PARTIAL DENTURES (FPD’S / BRIDGES)

These can be divided into PFM and all ceramic. Studies have shown survival rates to be 92% over 10 years, and 75% over 15 years for the PFM type, 93% survival rates over five years for zirconia, and 89% survival rates over five years for all ceramic FPD’s. The sharp decline in survival rates after 10 years (PFM) can be attributed to material fatigue (of the restoration or luting cements), recurrent caries, or retention loss. FPD’s on implants have 87% 10-year survival rates.

RESIN BONDED FIXED PARTIAL DENTURES (MARYLAND)

Longevity rates for these types of restorations vary widely, with some studies showing 88% five year survival rates. They are mostly lost due to de-bonding. Those in the anterior regions seem to survive longer than those in the posterior regions. Posterior restorations in the maxilla survive longer than those in the mandible, possibly due to greater masticatory forces being applied to the posterior mandible causing more frequent de-bonding at this site.
When these restorations are re-bonded there are greater failure rates, with 40% failing after their first re-bonding and 60% failing after second re-bonding respectively. Inappropriate case selection, and design flaws will not be corrected by re-bonding these types of restorations, which can explain their high failure rates.²

ENDODONTICALLY TREATED TEETH

When restoring endodontically treated teeth, the use of the sandwich technique, where a glass ionomer base is covered with overlying composite resin, is the preferred method for minimizing coronal leakage.¹³ When there is inadequate tooth structure remaining, cast post and core restorations have been found to have success rates of 90% over 10 years.²⁰ If pre-fabricated posts need to used, fibre-reinforced posts offer better long-term success compared with metal posts, as these tend to cause more root fractures due to their higher modulus of elasticity compared with dentine.²¹ Sealer selection is also important with AH-26 (epoxy sealer) offering better resistance to leakage than ZOE (zinc oxide eugenol) based sealers.¹⁹ Endodontically treated teeth can have survival rates of 97% over 5-8 years if adequately restored.²²

CONCLUSION

The longevity of restorations is dependent on a multitude of factors making it difficult to compare success rates. Based on current findings, we can, however, convey evidence-based information to our patients regarding anticipated restoration survival rates. It is essential to establish effective communication with our patients so that they can make informed decisions regarding their treatment.

References
4. Goldstein GR. The longevity of direct and indirect posterior restorations is uncertain and may be affected by a number of dentist-, patient-, and material-related factors. Journal of Evidence-based Dental Practice. 2010;10:30-1.
15. Ivoclar/Vivadent. IPS e.max scientific report. 2001-2013;vol.2.
SCENARIO
A 28 year old woman in her first trimester of pregnancy attends the dental surgery as a new patient. She presents with a periapical abscess on her first molar tooth and expresses concern about the numerous unfilled cavities that may cause problems during her pregnancy. She had last visited a dentist over five years ago and brought a set of radiographs taken during one of those appointments. The proposed current treatment plan was explained together with the need to update the type and number of the radiographs that were required. She said that she was worried about the risk of miscarriage and could her old radiographs not be used instead of taking new ones?

COMMENTARY
Pregnancy induces various changes to a mother’s body including the oral cavity. Pregnant women develop physical signs and symptoms that can affect their health, their perceptions and interactions with others and they may require various levels of support including medical monitoring, preventive care, and physical and emotional help. The collective systemic changes that occur in the cardiovascular, haematologic, respiratory, renal, gastrointestinal, endocrine, and genito-urinary systems pose various challenges when providing dental care for pregnant patients with dental management requiring special attention. Dentists need to have a good understanding of the physiological changes of the body, the effects of any dental radiation and of the medications which are used in dentistry for pregnant women and lactating mothers. Delayed elective procedures and alterations to treatment planning may be necessary.

The developing foetus has been shown to be susceptible to the effects of radiation, particularly during the first 2 to 18 weeks of development. The level of radiation will determine the damage that may result in miscarriages, birth defects or mental impairment. However, dental radiation exposure of the foetus is negligible. The frequency of mutations and adverse effects is directly related to the dose, and the risk is augmented when higher than necessary radiation exposures are used to compensate for any inadequacies in quality of processing. The radiations from maxillary anterior views may pass through the abdominal area, with penetration from the primary beam, as well as from scatter radiation. Depending on the head position, a similar exposure could also occur with the posterior views. A lead shield/protective apron, thyroid collar and current standards of radiation safety must be maintained to minimize harm to the foetus. In addition, the use of high-speed film, filtration and long cone rectangular collimation significantly decrease radiation exposure. Digital radiography may further decrease any potential risk.

In the above-mentioned scenario, the dentist is placed in a dilemma by the patient’s request – and needs to carefully consider the ethical principles of respecting autonomy, non-maleficence (doing no harm) and beneficence (doing good). Questions the dentist may need to consider include whether it is safe to provide treatment in the first trimester of her pregnancy? How urgent is her dental treatment? Can treatment be delayed? The respect for patient autonomy is critical in obtaining valid informed consent. Autonomy refers to the right of every individual to make decisions for him/herself and this would entail allowing the patient to make the final decision regarding his/her treatment options, after having been provided with all the necessary and relevant information.

Before subjecting a patient to any diagnostic investigations, it is an ethical and a legal requirement that their agreement and consent is obtained. Consent must be voluntary and it is essential that the patient be given all the relevant information related to the procedure or treatment, and in language that is easily understandable. The patient should be able to make a choice based on an understanding of the information given to her regarding the diagnosis, and the investigative procedures and their consequences, enabling a reasoned assessment of the proposed treatment options. To allay the patient’s fears, the improved science and technology of modern day radiography should be carefully explained to the patient and the possibility that performing any treatment without current radiographs may cause more harm than good. Beneﬁcence refers to doing good and dentists have a responsibility to provide beneﬁcial treatment, to beneﬁt patients by not inﬂicting harm, by preventing and removing harm. Whenever we try to help others, we inevitably risk harming them, but it is essential to balance the ethical
principles to achieve net benefit for the patient. The risk-benefit ratio related to any intervention is therefore crucial. In some circumstances it is difficult to decide what constitutes a harm and what constitutes a benefit, and there are instances when harm is caused to patients as a result of a distortion in the risk benefit assessment. When risk exceeds benefit, one needs to assess whether this unavoidable or intentional.

The “best interest” of patients means that professional decisions of proposed treatments and any reasonable alternatives proposed by the dentist must consider patients’ values and personal preferences. To do this dentists need to carefully communicate with their patients, but listening is also important. There are instances when patient desires conflict with professional recommendations. Patients must be informed of possible complications, alternative treatments, advantages and disadvantages of each, costs of each, and expected outcomes. Together, the risks, benefits, and burdens can be balanced. It is only after such consideration that the “best interests” of patients can be assured.

CONCLUDING REMARKS

Pregnancy is an ideal time to begin educating the mother on prevention. It is best if such treatment as possible is postponed until after parturition and the reasons for this are twofold. Firstly, the developing child is at a greatest risk from teratogens during organogenesis, and secondly, the risk of spontaneous abortions during the first trimester is high. Dental treatment during the time of a spontaneous abortion may be implicated as the cause and lead to litigation. During the first trimester (1-12 weeks) of pregnancy, it is recommended that the patients be educated about the oral changes which occur during pregnancy, what changes that they should expect, how to avoid oral and dental infections that may arise from these changes. The use of drugs (especially general anaesthesia) and radiography should also be avoided. Table 1 provides a guideline for dental management during pregnancy. Dental professionals must have a basic understanding of the underlying physiological changes of pregnancy, the influences of medications during gestation, and how they may interact with the delivery of dental care. In addition, they must balance the diagnostic needs and evidence-based science with the desires of the patient, use tested selection criteria and maximise the efficiency of the radiographs taken.

Table 1: Dental management guidelines during pregnancy

<table>
<thead>
<tr>
<th>Trimester</th>
<th>Current recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>First trimester (1-12 weeks)</td>
<td>1. Educate patients about oral changes that occur during pregnancy.</td>
</tr>
<tr>
<td></td>
<td>2. Emphasise strict oral hygiene and plaque control.</td>
</tr>
<tr>
<td></td>
<td>3. Limit dental treatment to periodontal prophylaxis and emergency treatments only.</td>
</tr>
<tr>
<td></td>
<td>4. Avoid routine radiographs. Use selectively and only when needed.</td>
</tr>
<tr>
<td>Second trimester (13-24 weeks)</td>
<td>1. Oral hygiene instructions and plaque control.</td>
</tr>
<tr>
<td></td>
<td>2. Scaling, polishing and curettage if needed.</td>
</tr>
<tr>
<td></td>
<td>3. Control of active oral diseases, if any.</td>
</tr>
<tr>
<td></td>
<td>4. An elective dental care is safe</td>
</tr>
<tr>
<td></td>
<td>5. Avoid routine radiographs. Use selectively and when needed.</td>
</tr>
<tr>
<td>Third trimester (25-40 weeks)</td>
<td>1. Oral hygiene instructions and plaque control.</td>
</tr>
<tr>
<td></td>
<td>2. Scaling, polishing and curettage if needed.</td>
</tr>
<tr>
<td></td>
<td>3. Avoid an elective dental care during the 2nd half of the third trimester.</td>
</tr>
<tr>
<td></td>
<td>4. Avoid routine radiographs. Use selectively and when needed.</td>
</tr>
</tbody>
</table>

References

INTRODUCTION

An 18 year old girl and her boyfriend were spending the afternoon on the grassy banks of a dam near Beaufort West. They were suddenly overpowered by three young men wearing balaclavas. The young girl was severely beaten in the attack, see Figure 1. During the attempted rape she was bitten several times on the neck and facial area, see Figure 2.

The attackers were fortunately disturbed by passers-by and fled the crime scene taking only the victims wallets and cell phones. The couple went straight to the girl’s house where her mother immediately bathed her and put plasters on any wounds that she could see. She then took photos of “all” the evidence. The next day they reported the case to the police. The mother did not want the police to take what she felt were private photos of her daughter but she assured the police that she had ample photos of the evidence. The police accepted her photos and filed them as evidence.

Several weeks after the incident had taken place the photographic evidence was brought to us to analyse. As a result of the poor quality of the evidence no analysis was possible. No DNA swabs were taken as the mother had assisted her daughter in cleaning off any possible saliva, semen or trace evidence which could have been present. The photos were unusable as they were not taken in the correct way: the photos had been taken at an acute angle and no metric ABFO rule was used. The photos did not include a case number, any identifier or a shade scale.

DISCUSSION

It is extremely important to follow the correct protocol when collecting bite mark evidence. Every bite mark should be correctly processed. The steps which should be followed include: fulfil all the legal requirements, photograph the bite mark, take DNA swabs, take silicone impressions of the bite marks, document all the procedures and store all the information correctly.

In this case, the washing of her daughter’s body by the mother destroyed all possible chances of securing a DNA profile of the suspects. The over caring mother was initially only interested in her daughter’s wellbeing and did not realise the consequences of her actions. The mother was also apprehensive about police officers at the local charge office taking photos of her daughter. The extent of the injuries would have meant the police would have had to take photos of her undressed daughter which she was not prepared to allow. The collection of evidence by the mother and the receipt of the evidence by the police without following correct protocols e.g. without taking impressions of the bite marks, made any form of analysis impossible. If the mother of the victim was better informed, she would have taken her daughter straight to the nearest police station, where they would have referred her to the nearest rape clinic, where all the necessary evidence would have been collected in the correct and appropriately sensitive way.

CONCLUSION

Dentists should be familiar with the protocol for collecting bite mark evidence. Dental awareness programs must inform the public regarding procedures to be followed in cases of violent crime when bite marks are present. The public must know their rights regarding confidentiality, the care which is available and the procedures to be followed. Dentists should advise local clinics that they are well equipped to assist in such cases.

Reference

Maxillo-facial radiology case 136

Below are a clinical picture and skull radiographs of a patient having a developmental field defect, probably occurring between 21 and 70 days of uterine life, rather than an individual syndrome. As such the etiology and pathogenesis are probably heterogeneous. What is your diagnosis?

INTERPRETATION

A diagnosis of frontonasal malformation was made. Frontonasal malformation has been defined as a combination of two or more of the following characteristics: hypertelorism, broadened nasal bridge, medium facial cleft affecting the nose and the upper lip and sometimes the palate, unilateral or bilateral clefting of the nasal alae, lack of formation of the nasal tip. The appearance of cranium bifidum (also known as cleft skull or enlarged parietal foramina) is characterized by the unsuccessful midline migration of the cranial vault, and a V-shaped hairline prolongation onto the middle of the forehead. The clinical picture (Fig. A) shows many of the characteristics mentioned above. The postero-anterior view of frontonasal malformation (Fig.B) shows hypertelorism, a widened nasal bridge and persistence of the metopic suture (arrow). A further postero-anterior view (Fig. C) shows persistence of the anterior fontanelle and a widened nasal bridge (arrow) with concomitant hypertelorism. The Waters view (Fig.D) demonstrates the hypoplastic maxillary sinuses. There is also marked hypertelorism and a widened nasal bridge.

Reference
1. Farman AG, Nortjé CJ, Wood RE. Oral and Maxillofacial Imaging, 1st Ed, Mosby, St. Louis, Missouri, 1993, pp. 122-123
What’s new for the clinician?
Summaries of and excerpts from recently published papers

1. Is progression of periodontitis relevantly influenced by systemic antibiotics? A randomized clinical trial


Periodontitis is an inflammatory disease caused by a microbial biofilm.1 Mechanical debridement in patients with moderate to severe periodontitis can be supplemented with systemic antibiotics, such as amoxicillin and metronidazole. The rationale for the adjunctive use of antibiotics is to effect an antimicrobial effect at sites inaccessible to mechanical therapy, and possibly to suppress periodontal pathogens.1 However, the indiscriminate use of antibiotics could increase bacterial resistance and thus a critical appraisal of routine prescription and its clinical relevance is mandatory for each patient.1 Harks and colleagues (2015)1 undertook a large multi-centre trial aimed at determining the efficacy of systemic antibiotics on the progression of periodontal disease. Their hypothesis was that empiric systemic adjunctive antibiotics could reduce the proportion of sites exhibiting further disease progression.

MATERIALS AND METHODS

The study was a prospective, randomized, stratified, double-blind, multi-centre (eight university hospital centres) trial with parallel-group design. Patients with untreated moderate to severe chronic and aggressive periodontitis were included. For inclusion, patients had to have pocket probing depths (PPDs) of ≥6 mm at a minimum of four teeth, at least 10 natural teeth, etc. Patients allergic to the tested antibiotics, those with systemic disease, rampant caries, etc. were excluded.

Per patient, 12 visits over 27.5 months were scheduled. Participants were divided into four strata according to the extent of periodontal disease [localized: <38%; generalized: ≥38% of teeth with pocket probing depths (PPD) ≥6 mm] and smoking habit [non-/light smoker: <7 ppm CO in exhaled air; moderate to heavy smoker: ≥7 ppm]. The four strata were defined as follows: stratum 1 (localized periodontal disease, non-/light smoker), stratum 2 (generalized periodontal disease, non-/light smoker), stratum 3 (localized periodontal disease, smoker) and stratum 4 (generalized periodontal disease, smoker).

After screening (visit 1), baseline measurements and subsequent randomization were performed (visit 2). After dental biofilms were disrupted during initial treatment (mechanical debridement), blinded amoxicillin/metronidazole or placebo was dispensed (visit 3). Re-evaluation (visit 4) was performed 3.5 months after visit 2. Maintenance therapy (mechanical debridement) was carried out at 3 monthly intervals (visits 5 through 12). Measurements were also conducted 9.5, 15.5, 21.5 and 27.5 months after visit 2 (visits 6, 8, 10 and 12).

From 506 randomized patients, 93 dropped out over the 27.5 months study period. Overall, 406 patients were included in the intention to treat analyses, but, due to incomplete medication intake, only 345 patients were included into the per-protocol analysis.

Within 1.5 months after baseline examination (visit 2), patients received supra- and subgingival debridement in up to two sessions on two consecutive days (visit 3). All mechanical therapy was performed with different hand instruments and/or machine driven scalers. After completion of mechanical therapy, in the antibiotics group, patients received two empiric antibiotics [Amoxicillin-ratiopharm 500mg®]; metronidazole 400mg (Flagyl®)] and placebo group patients two placebo drugs, each to be taken three times a day for 7 days.
The patients kept a medication diary to document drug adherence. Patients were informed about the medications’ side effects according to the package inserts of amoxicillin and metronidazole. Re-evaluation (visit 4) was performed 3.5 months after baseline. Thereafter, all patients received maintenance therapy, including full-mouth supra- and subgingival debridement and oral hygiene instruction at 3 months intervals (visits 5 through 12). Sites with PPD ≥4mm also received subgingival re-debridement. All treatments were performed by blinded qualified dentists or dental hygienists.

Full-mouth periodontal measurements were carried out at six sites of each tooth by blinded examiners not involved in periodontal therapy. Relative attachments level (RAL) measurements, corresponding to the distance from occlusal surface to the bottom of the periodontal pocket, were performed in duplicate with an electronic pressure-sensitive probe (Florida Disk Probe) in increments of 0.2mm. The difference between baseline and follow-up RAL readings described the changes of the clinical attachment level (gain or loss of tooth supporting tissue).

The primary outcome was the proportion of sites per patient with new clinical attachment loss (PSAL) ≥1.3mm between baseline and the 27.5 months visit. The ≥1.3mm threshold was considered clinically relevant, because conversely, 1.3mm gain in clinical attachment after periodontal therapy is considered a relevant outcome, too.

Attachment loss was used as outcome variable instead of attachment gain, because it is associated with tooth loss, which constitutes a true endpoint. Therefore, the presence of attachment loss is tantamount to disease progression. The following secondary endpoints were assessed exploratorily using a Florida standard probe: PPD, clinical attachment, gingival bleeding on probing and supragingival plaque. All measurements were performed at “baseline” (visit 2), after 3.5 months (re-evaluation, visit 4), and at 9.5, 15.5, 21.5 and 27.5 months “follow-ups” (visits 6, 8, 10 and 12).

The medical history and the body mass index were assessed at visit 1, and non-fasting blood samples were drawn to determine the HbA1c levels (visits 1, 8 and 12). As an indicator of subjective oral health perception, the German version of the Oral Health Impact Profile (OHIP-G 49) was recorded at visits 1, 8 and 12.

All efficacy analyses were based on the intention to treat (ITT) principle, comparing groups according to the randomly assigned treatment and strata. Primary and secondary endpoints were evaluated in the per-protocol collective at each visit. A sensitivity analysis was performed with PSAL ≥2 mm.

RESULTS

Of 506 randomized patients, 406 (placebo: n = 200, antibiotics n = 206) finished the therapy regime by visit 12 (drop out n = 100; 19.8%). All patients who followed the study timeline according to the protocol and took all tablets within 6 through 8 days according to their medication diaries were included in the per-protocol collective (PP, 345 patients, placebo: n = 175, antibiotics: n = 170). Most patients in the sample had been diagnosed with chronic periodontitis.

In the intention to treat (ITT)-collective, the median proportion of sites per patient with new clinical attachment loss (PSAL) ≥1.3mm over the 27.5 months period was 7.8% in the placebo versus 5.3% in the antibiotics group. The difference between the patient groups was significant (p < 0.001).

At baseline (visit 2), the percentage of PPD ≥5mm was not different in both groups (p = 0.66). Beginning with visit 4, although both groups achieved clinically favourable levels, the antibiotics group patients showed statistically noticeable lower presence of PPD ≥5 mm compared with placebo patients (p < 0.001).

At 27.5 month, % PPD of ≥5mm had decreased to 5.5% in the placebo and to 2.1% in the antibiotics group (p<0.001). The median proportion (ITT-collective) of sites with attachment gain ≥1.3mm over the 27.5 months period was 12.2% for the placebo and 19.4% for the antibiotics group (p < 0.001). Clinical attachment level overall improved over the study period: mean attachment gain was 0.4 ± 0.7mm for the placebo and 0.6 ± 0.7mm for the antibiotics group (p < 0.001). In both groups, this gain was considerably more pronounced at sites with initially advanced probing depths of ≥6.5mm (placebo 2.1 ± 1.7mm versus antibiotics 2.8 ± 1.5mm; p < 0.001).

In summary, other secondary parameters, for example proportions of PPD and absolute PPD and bleeding on probing improved over the 27.5 months observation period, whereas the plaque index scores improved initially, but returned to baseline levels later.

Overall, 90 serious adverse events, 39 in the placebo and 43 in the antibiotic group were reported over the course of the study. Eight serious adverse events occurred prior to medication intake.

At baseline, the mean OHIP scores were 39.2 ± 27.2 for the placebo and 46.0 ± 33.8 for the antibiotics group. These scores decreased in the course of the study to 32.2 ± 29.4 and 32.9 ± 29.4 for placebo and antibiotics patients with mean changes of −5.5 ± 21.3 and −11.0 ± 26.1 respectively. The effect size (Cohen’s d) of the score changes from baseline to 27.5 months between the two groups was d = 0.23 (95% CI 0.03; 0.44).

CONCLUSION

The authors found that in the present trial, compared with placebo, the prescription of empiric adjunctive systemic amoxicillin plus metronidazole was highly effective in terms of PPD reduction, but showed little absolute, although statistical significant, reduction in further attachment loss in formerly untreated patients with moderate or severe chronic periodontitis.

IMPLICATIONS FOR PRACTICE

Mechanical debridement was highly effective in the prevention of new attachment loss and improves the majority of other clinical parameters. Results of mechanical therapy were statistically significant improved by the prescription of adjunctive antibiotics, but these improvements depend on the outcome parameter and are of conflicting clinical relevance in real life. Against the background and danger of increasing microbiological resistance, it seems even
more reasonable that for routine treatment of periodontitis clinicians should consider the patient’s overall risk for periodontal disease when making a decision for or against antibiotic prescription, and should be careful not to underestimate the effect of proper mechanical debridement and modification of behavioural risk factors.

2. Effect of application of a PVP-iodine solution before and during subgingival ultrasonic instrumentation on post-treatment bacteraemia


The presence of germs in the bloodstream is referred to as bacteraemia. Bacteremia frequently occurs after treatment procedures such as extractions, scaling, root planing, periodontal probing, periodontal surgery, suture removal, orthodontic treatment, restorative dentistry, non-surgical root canal treatment, subgingival irrigation, and oral hygiene procedures such as tooth brushing and flossing. Guidelines have been developed for the preventive systemic administration of antibiotics before dental treatment, especially for well-defined high-risk patients such as those with cardiovascular disease, diabetics, those with immunosuppressive conditions with weakened immune states, etc. Despite the fact that some studies showed that the antibiotic approach might be highly potent in terms of bactericidal effects on circulating germs in the bloodstream, this medication does not actually provide a safe elimination of bacteria or any obstacle for the transition of viable bacteria into the bloodstream.1

PVP-iodine is a cheap broad-spectrum antiseptic agent frequently used in the therapy of periodontitis. Its spectrum of action covers bacteria associated with periodontitis and its use as a rinse during initial periodontal therapy has been proven to provide a significant therapeutic benefit in terms of pocket depth reduction.1 Sahrmann et al (2015)1 reported on a trial that sought to assess the impact of PVP-iodine rinsing before ultrasonic root instrumentation and concomitantly with this instrumentation, on the prevalence and the extent of oral-borne bacteraemia in patients with chronic periodontitis.

MATERIALS AND METHODS

This was a single-centre, randomized, placebo-controlled clinical study with a split-mouth crossover design. The study was composed of 20 male and female patients over 18 years of age with moderate or severe chronic periodontitis with at least two sites with probing depth (PD) ≥ 5mm in each quadrant. Patients with systemic diseases or medications known to interfere with periodontal therapy were not included. Furthermore, patients who underwent antibiotic therapy or anticoagulation therapy during the preceding 6 months, those on thyroid medication or with a known allergy to PVP-iodine were excluded from this study. Females who were pregnant or breastfeeding were also not included in this trial.

A computer-randomized list was generated prior to the start of the study. During the first appointment, an envelope with the group and allocation of the first course of instrumentation, i.e. left or right half of the mouth, and the solution to be applied was defined: PVP-iodine for the test or tap water for the control treatment.

After local anaesthesia was administered to areas with deep periodontal sites of the appropriate half of the oral cavity, the patient rinsed the mouth for exactly 1min with the corresponding test or control liquid. Meanwhile, a tourniquet was loosely placed around the upper arm, and the bend of the elbow was disinfected twice. Then, all periodontal sites in the area of interest were rinsed for another 60 sec with the same liquid using a 10ml single-use plastic syringe and a blunt tip with an inner diameter of 0.49mm. Thereafter, these pockets were instrumented using an ultrasonic-driven device (CavitronPlus® and Slimline inserts) at the highest settings for power and lavage to churn up a maximum of subgingival biofilm for 60 s. During the study process, the ultrasonic device ran with the allocated liquids provided from the external cooling tank (either PVP-iodine – test or water – control). Exactly 3 min after the start of the subgingival instrumentation, a blood sample of 10 ml was taken from the most visible arm vein after tightening the tourniquet.

The second treatment was performed after a wash-out period of at least two weeks. The treatment was performed in line with the first treatment using the residual liquid so that the patient would have received exposure to both the test and the control liquid as is consistent with crossover trials.

Samples were labelled and stored in a dark place at room temperature until they were processed in the laboratory. Due to the coding of the glass tubes, the microbiology staff was blinded regarding the treatment type of the corresponding blood samples. The samples were centrifuged at 3500g for 10 min and placed in growing media for culture at 37°C for 2–3 days. As soon as colonies were visible, they were counted and sub-cultured using standardised procedures.

Clinical data from the periodontal findings sheet were transferred and inserted into an Excel spreadsheet to automatically calculate the total epithelialized and inflamed surfaces from the pocket depth, recession and BOP data, based on reference data for the anatomy of the individual teeth.

Reference

RESULTS

Of the 20 patients enrolled in the study, results were presented for 19. Baseline clinical data (PI, BOP, number of sites with deep probing depths, mean probing depth, the mean overall (PESA) and inflamed periodontal surface area (PISA)) did not reveal any statistically significant differences between the groups. For the cultures, bacteria of oral origin included different *Streptococcus spp.*, *Lactobacillus spp.* and facultative anaerobic bacteria such as *Actinomyces spp.* but also strictly anaerobic bacteria such as *Prevotella spp.*, *Clostridium spp.* and *Fusobacterium spp.*

Bacteraemia was found in 11/19 cases in the control group and in 5/19 cases in the test group. After the exclusion of cases with typical skin bacteria species, 10/19 (53%) oral-borne bacteraemia were found in the control group and 2/19 (11%) in the test group. After the exclusion of cases with typical skin bacteria species, 10/19 (53%) oral-borne bacteraemia were found in the control group and 2/19 (11%) in the test group. Multiple regression revealed no correlation of the parameters BOP, PI, number of sites ≥ 4mm, PESA or PISA with the prevalence of bacteraemia (p-values 0.087, 0.245, 0.214, 0.242, 0.417) or with the number of bacteria per case of bacteraemia (p-values 0.868, 0.310, 0.493, 0.802 and 0.672 respectively). However, there was a correlation of BOP and the number of sites > 4mm (p=0.004).

CONCLUSION

The researchers concluded that rinsing with 10% PVP-iodine significantly reduces the risk for post-treatment bacteraemia during non-surgical periodontal therapy.

IMPLICATIONS FOR PRACTICE

Before undergoing dental treatment, patients at a high risk for endocarditis or inflammation of endoprosthesis are encouraged to take prophylactic antibiotics to kill vital bacteria that have entered the bloodstream. However, antibiotics do not hinder the passage of vital bacteria into the host organism. Intensive rinsing with PVP-iodine before and during biofilm disruption might be an alternative approach to lower the risk of bacteraemia.

Reference

An investigation into the incidence and distribution of fractures of the coronoid process in patients presenting at the Medunsa Oral Health Centre (MOHC) (p384)

1. It is possible that a coronoid fracture can be caused by reflex muscular contractions, even in the absence of a direct blow to the mandible.
   a. True
   b. False

2. In general the consensus is that coronoid fractures should be managed conservatively.
   a. True
   b. False

Managing stress in the Dental environment (p 388)

3. These are the key stressors in dentistry:
   a. running behind schedule;
   b. causing pain;
   c. heavy workloads;
   d. late patients;
   e. anxious patients.
   a. True
   b. False

The longevity of restorations- a literature review (p 410)

4. When Maryland bridges are rebonded after a first failure, the likelihood of a second failure is:
   a. 22%
   b. 45%
   c. 35%
   d. 40%

5. It is a fact that 60% of operative dentistry time is spent on effecting repairs to previous restorations.
   a. True
   b. False

Fracture behaviour patterns of cusp replacing fibre strengthened composite restorations (p 390)

6. Identify the incorrect statement:
   Composite resin restorations:
   a. have low flexural strength
   b. are prone to crack propagation
   c. may effectively be strengthened by the addition of micro scale fibres
   d. may effectively be strengthened by reducing the content of ceramic fillers
   e. have enhanced performance when fibres are used in a composite substructure

7. Adhesive restorations transfer and distribute functional stresses across the bonding surface and also reinforce weakened tooth structure.
   a. True
   b. False

Dental Caries status in six-year-old children at Health Promoting Schools in KwaZulu-Natal, South Africa (p 396)

8. Results from the 2003 National Oral Health Survey indicated that 35.2% of 6-year-olds in KwaZulu-Natal were caries free and only 40% received dental treatment.
   a. True
   b. False

9. The caries rate for 6-year-olds in KwaZulu-Natal in this study was 55%.
   a. True
   b. False

10. How many National Oral Health studies have been conducted in South Africa?
    a. 1
    b. 2
    c. 3
    d. 4
    e. 5

11. The percentage of teeth requiring fillings in the current study was:
    a. 10%
    b. 4.6%
    c. 8%
    d. 15%
    e. 25%

12. The percentage of untreated caries in this study was:
    a. 71%
    b. 25%
    c. 43%
    d. 88%
    e. 60%

Comparison of colour differences in visual versus spectrophotometric shade matching (p 402)

13. The major problems of colour matching with visual shade guides are the subjective variability of shade matching, the polychromatic nature of teeth, and the limitations of dental shade guides that incompletely represent the colour space of natural teeth.
    a. True
    b. False
14. Spectrophotometers are efficacious in quantifying the natural tooth colour and enable communication between technicians and dentists to be more uniform and accurate.
   a. True
   b. False

15. CIE L*a*b* system is based on hue, chroma and value.
   a. True
   b. False

16. Whenever possible, both the digital and visual colour matching method should be used, as they complement each other and can lead to a more predictable aesthetic outcome.
   a. True
   b. False

Maxillo-facial Radiology case book 136 (p 417)
17. In frontonasal malformation a V-shaped hairline prolongation onto the middle of the forehead may be present.
   a. True
   b. False

18. Hypertelorism is not a common finding in frontonasal malformation.
   a. True
   b. False

Clinical Windows (p 418)
19. In the Harks et al trial, the median proportion of sites per patient with new clinical attachment loss (PSAL) \( \geq 1.3 \text{mm} \) over the 27.5 months period statistically better in the antibiotics group.
   a. True
   b. False

20. In the The Sahrmann et al trial, the average number of colony forming units per case of oral-borne bacteremia was higher in the antibiotic group.
   a. True
   b. False

21. “First do no harm” – non maleficence is one of the guiding principles of the healthcare sector.
   a. True
   b. False

22. All dentists have the responsibility to provide beneficial treatment, to benefit patients by not inflicting harm, by preventing and removing harm.
   a. True
   b. False

23. From an ethical perspective, the principle of autonomy requires the dentist to:
   a. “Tell the truth”
   b. “Respect the privacy of others”
   c. “Protect confidential information”
   d. “Obtain consent for interventions with patients”
   e. All of the above

24. It is not necessary for health care practitioners to always regard concern for the best interests or well-being of their patients as their primary professional duty.
   a. True
   b. False

25. National Health Act of No. 61 of 2003 requires that the following information be given to the patient:
   a. Range of diagnostic procedures and treatment options available
   b. Benefits, risks, costs and consequences associated with each option
   c. User’s right to refuse care, in which case the dentist should explain the implications, risks and obligations of such refusal
   d. Furthermore, this information must be provided in a language that the patient understands and in a manner that takes into account the patient’s literacy level.
   e. All of the above

Readers will note that we have reduced the number of General Questions to twenty whilst retaining five Ethics based questions. Our allocation of CPD points remains unchanged. There is optimism that this section will continue to provide members with a valuable source of CPD points whilst also achieving the objective of CPD, to assure Continuing Education.

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23. A dental record may be used:
   a. as a basis for planning and maintaining continued patient care.
   b. as a record of communication regarding the patient and other health care providers.
   c. to protect the legal interests of all parties involved.
   d. for billing, quality assurance, and other administrative functions.
   e. all of the above.

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