event
Clinical Innovations Conference 2012

user report
Ultrasonic irrigation

research
Root canal morphology
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Dear Reader,

Welcome to the second issue of Roots for 2012.

It has been a busy time in dentistry lately. There have been many conferences and events to attend, not least of all the ninth Clinical Innovations Conference, held in London.

For Endodontists it was a real treat of an event, with much of the programme given over to world class speakers in all areas of endodontics. Of course, being Clinical Innovations, much was centred on technologies which can aid in root canal treatment. To find out more about the event, turn to pages 8–11.

In this issue we feature two user reports looking at ultrasonic irrigation. One is the investigation of the effects of power setting, type of irrigant and duration of ultrasonic irrigant agitation using a particular stainless steel instrument. Backing this up is a presentation of ultrasonic irrigation used in a retreatment case. You’ll find these on pages 14–20

Here at Roots we would love to hear your feedback on the journal as well as your input into the content. Send us your comments (good and bad!), articles, case studies etc to lisa@dentaltribuneuk.com. I look forward to hearing from you

Until next time...

Lisa Townshend

Group Editor

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Cycle Slam is huge success

On St George’s Day, former England rugby international and World Cup winner Lawrence Dallaglio and England cricketing legend Freddie Flintoff embarked on the cycle ride of their lives.

The Dallaglio Flintoff Cycle Slam 2012 (supported by Virgin Media) began at the ancient birthplace of the Olympic Games, Olympia in Greece, on 23rd April. The journey stretched over 22 days, and took them through Italy, across the Swiss Alps and through France, before reaching London on 18th May.

JHA’s very own Dr Alyn Morgan, endodontist at U Dentistry in Ilkley, joined Freddie and Lawrence for the last of the five stages of the ride. He undertook this massive challenge in order to raise donations for three fantastic charities – the Dallaglio Foundation, the AF Foundation and Virgin Unite.

A huge congratulations to Alyn and everyone else who took part in this incredible achievement!

For more information about JHA’ dental practices call 02920 772 930 or visit www.jameshull.co.uk

Dental practice offers award for young endodontists

The Harley Street Centre for Endodontics is launching the Young Dentist Endodontic Award 2012. Marking the 10th Anniversary of the Centre, the award is open to any young dentist who graduated in the last three years, whether they are in their Foundation Year or just starting out on their career. Applicants are invited to submit a case report of their best endodontic treatment so far. An application form can be downloaded from: www.roottreatmentuk.com.

In addition to the national recognition that the award will bring, there are five outstanding prizes to help the top applicants develop their endodontic skills further. First prize is the new WaveOne Endodontic Motor, hand piece and accessories kit, from Dentsply UK and the second prize is a Morita Root ZX apex locator from Quality Endodontic Distributors(QED). Three further runners up will win a pair of endo-benders from SybronEndo.

The application process is simple - Dentists are asked to submit details of one endodontic case which showcases their ability. The deadline for applications is 2 September 2012.
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The Clinical Innovations Conference 2012 was a fantastic success, boasting world-class speakers, cutting edge topics and practical advice for the many dental professionals in attendance.

Held at the Millennium Gloucester Hotel in London, the event saw more than 400 delegates from across the country come together for the two-day event.

As befits one of the leading aesthetic and restorative conferences held in the UK, delegates were able to expand and develop their understanding of ideas and techniques with help from some of the top names in the field. For the first time, the event included a London Deanery DFT Conference, running alongside the Clinical Innovations Conference, providing more variety and attracting a number of additional practitioners.

The event began on the Friday, with the world-renowned Nasser Barghi speaking on ‘All-Ceramic and CAD/CAM Restorations in 2012: Clinical Steps’, to a highly attentive audience.

After the coffee break the conference split into two streams; Dr Wyman Chan and Dr Anthony Roberts. Dr Chan gave a lecture on ‘Modern Bleaching Techniques’, focussing on bleaching techniques and the science behind the products he uses, as well as running a live demonstration.

Simultaneously, Anthony Roberts spoke about ‘The Periodontal Jigsaw: Putting it all Together’. Dr Roberts discussed BPE charting and the journey of diagnosis. He also explained the clinician’s role as motivator, communicator and educator in addition to their clinical capacity for the best treatment for patients.

The afternoon continued the high standard of

Fig. 1. The exhibition  
Fig. 2. Delegates had the chance to get their glad rags on at the gala dinner
speakers, with Richard Kahan giving an enthusiastic talk on 'New Horizons in Endodontic Diagnosis and Treatment Planning'.

Richard’s experience in endodontics provided an array of interesting and highly complex case studies to enhance his lecture.

Comparing the dental and medical industries, Richard highlighted the issue that dentistry has a far smaller range of tests to use when diagnosing a patient’s complaint. In fact, the only truly objective test is an X-Ray. This is not however, a totally reliable tool, as its limitations can affect the results shown. If an X-Ray does not show a specific problem, that does not necessarily mean there is nothing wrong — if a lesion for example is limited to cancellous bone, an X-Ray will not show it at all.

In effect, an X-Ray gives a ‘shadow’ of the tooth structure, so a 2nd and 3rd dimension is needed for an accurate diagnosis. The Limited Volume Cone Beam Computed Tomography (CBCT) gives this, and allows for a reliable and immediate diagnosis; preventing the possibility of working on the wrong tooth and causing more problems than existed originally.

Richard went on to discuss how safe the radiation dose is to patients when using the CBCT, and the necessary risk analysis that should be taken when using it. The degree of possible exposure depends on the tissue type, the age of the patient, the size of the face and whether there is any existing crown or bridge work present. Richard explained how he had previously experimented with his own machine in an attempt to lower the radiation dosage while producing clear results. He found that the CBCT emitted an amount equal to background radiation, and that the difference in the degree of exposure was insignificant to the patients. Proving his point further, he showed some mortality statistics, showing that one in 15,000 people died from effects of a head CT radiation exposure, opposed to only one in 1,000,000 associated with the CBCT.

Despite the essentially harmless amount of radiation patients are exposed to through a CBCT scan, Richard did express the importance of ensuring all patients and staff were educated in the possible risks. A CBCT machine is quick to produce reliable results, making the diagnosis easier for the professional and the patient.

Nasser Barghi, Mhari Coxon and Fraser McCord then separated the conference into three streams, speaking on ‘Bonded All Ceramic Restorations in 2012’, ‘Effective Biofilm Management’ and ‘Diagnosis of Complete Denture Problems’ respectively.

The first day concluded with Professor Gianluca Gambarini lecturing on ‘3D Endodontics: Concepts and Techniques’. Discussing the benefits of cone beam technology, he illustrated the importance of working with 3D images to diagnose patients’ complaints.

In order to see ‘the complete picture’, Professor Gambarini expressed the need to take radiographs from different angles. CBCT (Cone Beam Computed Tomography) is especially designed for complex cases and gives an accurate and high-resolution image of the patient’s mouth, including multiple root canals in teeth. This type of technology also enables the practitioner to switch between the buccal-lingual and mesio-distal view, greatly increasing the chances of finding any problem and therefore diagnosing and treating it correctly.

Professor Gambarini then looked at techniques to treat a variety of complicated endodontic problems. Using images from several previous case studies, he demonstrated some of the most commonly missed problems, showing that refined skills and techniques are essential. Accentuating the importance of using the correct instruments for the job, he spoke about the need to shape and clean the teeth thoroughly, to prevent difficult lesions forming in the future. According to Professor Gambarini, instruments should be highly flexible to allow for a more ‘centred’ and accurate preparation of difficult root canals, but resistant enough that they will not fracture or break when being used.

In most cases, the more simple the treatment, the lower the stress caused for both the practitioner and the patient. Professor Gambarini did, however, insist that simplicity should come after quality, particularly for complex endodontic cases. This enhances the need to create the most suitable
treatment plan for each patient, and then carry out procedures with the highest possible level of skill.

As a great believer that the ‘Anatomy dictates instrumentation’, Professor Gambarini showed that success of endodontic treatment can only be achieved if the most appropriate tools and techniques are adopted for each case.

In the evening, hundreds of delegates dressed to impress for an evening of fine food and dancing at the event’s gala dinner. Attendees were greeted by a champagne reception, and were able to relax and enjoy a sumptuous three-course meal, live entertainment in the form of dentist-turned-magician Dr Raj Rattan and fantastic company.

As part of the evening, the brand new Clinical Innovations Award was launched, designed to showcase the best, most innovative products currently on the market.

There was a fantastic range of entries, some of which were described as “breathtakingly brilliant”, others of which were defined as “superbly practical”; all were distinguished as having innovation at the heart of their solutions.

The judging panel consisted of a number of esteemed dental professionals, as well as members of a number of key journal editorial boards. As the award ceremony got underway, the judges were keen to comment on the variety and excellence of all the products short-listed, which had given the panel “great admiration” for all the companies involved.

With such a strong line-up of potential winners, the winner of the inaugural Clinical Innovations Award really had to stand out above the rest and after much careful deliberation, Dean of the London Deanery Elizabeth Jones announced the winner - the Morita Veraviewepocs 3D R100 X-Ray machine.

According to the judges’ statement it was a cut above the rest: “This is an amazing development. No one thought anyone could achieve it. The field of vision in the right trough providing accurate information has been almost impossible with rotational devices. This is a technological breakthrough of increasing an 80mm diameter cylindrical field of vision to 100mm triangulated field of vision – to simulate the shape of the triangulated mandible, now includes the missing anatomy without exposing other tissue. This improves accurate detailing and will enhance patient safety when diagnosis and treatment planning is undertaken.”

Launched in March 2012 the Veraviewepocs 3D R100 is the latest model in the Veraviewepocs 3D series of combination panoramic, cephalometric and cone beam CT devices. It re-defines the concept of 3D imaging with a unique Reuleaux Triangular FOV which more accurately matches the shape of the patients’ jaw. The R100 FOV includes relevant anatomy that would be imaged with a 100mm circular diameter cross section but excludes irrelevant tissues outside the jawline. Not only was it previously considered impossible to achieve anything other than a circular cross section, but by achieving this, the x-ray dose to the patient is comparatively lower by around 15 per cent.

The Highly Commended award went to W&H with its entry the Proface light probe; and the Commended award went to NSK S-MAX PICO Handpiece. Finalists for the award included Propoints.
from Smart Seal, the only obturation product to use hydrophilic polymers which absorb water and expand laterally within the root canal, creating a 3D mechanical seal.

The morning after the night before is always a tough start, but with speakers such as Basil Mizrahi and Ajay Kakar to look forward to delegates were fired up for the Saturday programme.

Dr Mizrahi discussed ‘Clinical Tips and Techniques to improve the aesthetic and biochemical precision of your dentistry’. A very practical-based lecture, Dr Mizrahi looked at ways to make the preparation of teeth easier.

As the Conference split into three sessions again, Professor Gambarini returned to speak about ‘Improving Root Canal Preparation and Obturation’. Simultaneously, Ajay Kakar lectured on ‘Non Surgical Management of Periodontal Disease’, Sandeep Senghera discussed ‘Treating Your Patients and Business to the Latest in Technology’ and Nasser Barghi spoke about ‘CAD/CAM Zirconia’ to MSc students.

Dr Senghera’s presentation was a practical look at marketing your practice to new and existing patients using the technology that many use daily in their personal lives – smartphones, social media etc. Likening the patient base to a bath with water running in and draining out, he emphasised the need to ensure patients are retained with smart recall processes and timesaving strategies for patients such as online appointment booking.

John Moore then took over the speaking to explore ‘Digital Dentistry and the Advantages for Cosmetic Treatments’. Primarily discussing how his practice is using the CEREC system to their advantage, Dr Moore showed how clinicians can use CAD/CAM in their practices to fulfil patients’ requirements.

Dr Barghi returned again in the afternoon to repeat his popular lecture on Bonding from the previous day, while Dr McCord’s lecture was ‘An Update on Impression Techniques for Complete Dentures’.

Nilesh Parmar looked at ‘Dentistry in the 3rd Dimension’. Discussing the clinical applications for CBCT in various branches of dentistry, Dr Parmar used many case examples using the technology to illustrate how, in his words, it ‘changed my working life’.

The Clinical Innovations Conference 2012 came to a close on the Saturday afternoon, with Dr Amit Patel speaking on ‘Peri-implantitis – a Future Timebomb’. One of the many strengths of the Clinical Innovations Conference is that it combines lectures with live workshops, demonstrations and a trade exhibition, to cater to practitioners’ every need. Between lectures, delegates were able to browse the exhibition stands, accessing some of the latest technologies in the world of aesthetic and restorative dentistry, and put their questions directly to the experts at each company.

Feedback from the event has been fantastic, with many delegates already penning the 2013 date in their diary. Next year’s event, the tenth anniversary of the Clinical Innovations Conference, will be held 17th–18th May 2013. See you there!
Dentistry has always been a challenging profession, and now, with regulation and competition between practices at an all-time high, it is perhaps more challenging than it’s ever been. Be it the CQC, the GDC, PCTs, or even the HMRC, there are just so many hurdles for us to cross, and hoops for us to jump through, it’s staggering that we have any time for our patients at all!

But while as a profession we have had to get used to the likes of CQC inspections and the need to fulfil regular quotas of CPD, there is one particular aspect to our role as employers that has given me great cause for concern in recent months. That is, employment law.

As a regular visitor to dentistry shows and conferences throughout the year I am always keen to attend lectures and listen to speakers share their thoughts on dentistry. I am especially interested to learn from our international colleagues, many of whom offer a different perspective to what we are used to here in the UK.

Our American colleagues in particular will often speak passionately on the subject of branding. According to the US philosophy, in order to run a successful practice – or indeed a successful business – staff should always reflect the nature of the organisation.

Time and time again, any speaker on branding will always say the same thing: if your staff isn’t ‘on brand’ then find staff who want to work for you!

In a British room, this message often leaves the audience feeling somewhat perplexed. This is because in the UK our labour laws very much favour the employee. As an employer then, if ever we were to employ someone who just wasn’t ‘doing it’ for us anymore, then we’d sorely struggle to part company with that employee on any grounds other than the most serious.

I fully understand the need for employment laws, and the need to protect employees’ rights. What I don’t agree with however is the completely debilitating and sometimes catastrophic consequences that some of these employment laws can have.

How is a dental practice expected to survive if an employee is required to be suspended on full pay during an investigation? Not only must the practice meet the cost of the suspended staff member’s pay, but they must also cover the cost of the replacement, and the loss of working ef-
ficiency experienced as a result. With employment laws as they stand even the smallest matter can potentially cripple a practice and run it into the ground.

There’s been some coverage in the press recently surrounding an amendment to employment law that is supposed to work in employers’ favour. Essentially it gives employers a two-years window in which they can legally still ask an employee to leave. While this might be a slight change to our benefit, I still can’t help but think this doesn’t address a number of the fundamental issues.

As an employer, if you have a grievance with a member of staff there will be an informal and formal grievance procedure, a disciplinary and even an appeal process. With the rise in unionism within certain areas of the profession, we are also now finding a number of unscrupulous individuals and organisations taking advantage of dentists’ ignorance of labour law. This has led to more people than ever pushing for the likes of unfair dismissal or constructive dismissal. Very often this doesn’t leave the dentist with a leg to stand on, and the practice will fast be out of pocket if they haven’t followed the correct procedure.

One striking example here is that if you sack someone and don’t tell them they’ve got a right to appeal then the industrial tribunal will always find for that employee, no matter what the problem was originally as the issue is a flaw in the procedure! Furthermore, dental practices will also find that if they don’t have the relevant documentation, policies or disciplinary procedures in place to protect themselves and their staff then they will find that they are themselves vulnerable to a successful complaint from a disgruntled prospective, present or even past employee. With employment law such a tricky and potentially troublesome issue for dental practices, it really does pay to have an advisor on your side. This is why I heartily recommend all colleagues outsource to a HR department that has all the relevant skills and expertise to deal with any employment issues that may arise. In this modern and increasingly challenging world, we just can’t afford to make these kinds of mistakes. I urge you then, to protect yourselves now – you never know what might be round the corner.

“How is a dental practice expected to survive if an employee is required to be suspended on full pay during an investigation?”

Dr Michael Sultan BDS MSc DFO FICD is a Specialist in Endodontics and the Clinical Director of EndoCare. Michael qualified at Bristol University in 1986. He worked as a general dental practitioner for five years before commencing specialist studies at Guy’s hospital, London. He completed his MSc in Endodontics in 1993 and worked as an in house Endodontist in various practices before setting up in Harley St, London in 2000. He was admitted onto the specialist register in Endodontics in 1999 and has lectured extensively to postgraduate dental groups as well as lecturing on Endodontic courses at Eastman CPD, University of London. He has been involved with numerous dental groups and has been chairman of the Alpha Omega dental fraternity. In 2008 he became clinical director of EndoCare, a group of specialist practices. For further information please call EndoCare on 020 7224 0999 or visit www.endocare.co.uk
The effect of ultrasonic irrigation variables on the dimensions of artificial root canals

Author: James Prichard

Aim: To investigate the effects of power setting, type of irrigant and duration of ultrasonic irrigant agitation with Irrisafe™ on the mean percentage change in the cross-sectional area and diameter of artificial root canals in an in-vitro model.

Methodology

Twenty-five extracted anterior human teeth were collected and split into 2 halves, each of which was embedded in epoxy resin. The external root surfaces were polished to produce flat, smooth dentine surfaces. A pilot score was used as a guide to prepare an artificial canal using rotary instruments to a size 30/06. The root canals were randomly assigned to five groups. Group 1: irrigation with 2.5 per cent NaOCl, ultrasonic agitation at power setting 7 (n=5); Group 2: irrigation with 17 per cent EDTA, ultrasonic agitation at power setting 7 (n=5). Groups 3, 4, and 5 were irrigated with 2.5 per cent NaOCl, 17 per cent EDTA, 2.5 per cent NaOCl, with ultrasonic agitation at power setting 4 (n=5), 7 (n=5) and 10 (n=5) respectively. Irrigant was delivered with a syringe and ultrasonically agitated with a PS Satelec® and Irrisafe™ tips. Canal area and depth were measured at 17, 16 and 9 mm from the canal orifice at baseline and after 1, 2, and 5 minutes of ultrasonic agitation.

This study came about as a result of a presentation that Chris Stock, Godfrey Cutts and I made to Prof Kish Gulabivala. We showed him a protocol for shaping and then cleaning root canals using Irrisafe. He announced that all steel instruments and tips remove dentine and cut root canals, so I set out to prove him wrong!

I would like to express my thanks to Prof Gulabivala for the idea behind this project and the incredible opportunity he afforded me.

Contemporary endodontics falls into three distinct categories:

1. Preparation (mechanical shaping)
2. Irrigation (syringe flushing and adjunctive cleaning)
3. Obturation (sealing the root canals in three dimensions)

The existence of several morphologically different micro-organisms was shown to be associated with necrotic pulps as early as 1984 by W.D. Millar. Bacteria in the root canal system has been shown to cause apical periodontitis in gnotobiotic rats (Kakehashi et al. 1965). Sundqvist demonstrated that 18 out of 19 traumatised but intact teeth associated with periapical radiolucencies gave positive bacterial cultures (Sundqvist 1975).

Schilder (1967) suggested that the root canal be cleaned and then shaped to allow for three-dimensional obturation. However, at least thirty-
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eight per cent of the root canal surface could remain uninstrumented during root canal treatment (Peters et al. 2001) and 70 per cent more debris remained following instrumentation when compared with instrumentation and irrigation (Baker et al. 1975).

Furthermore the landmark studies of Bystrom and Sundqvist (1981, 1983) demonstrated a 100-1000 fold decrease in bacterial counts when 0.5 per cent Sodium Hypochlorite (NaOCl) was introduced instead of saline. Therefore it has generally been accepted that a chemomechanical approach to root canal debridement is required to significantly reduce the bacterial load that may encourage more predictable healing.

The role of root canal preparation has therefore undergone a shift from one primarily fulfilling a debriding function to one regarded more as establishing radicular access to the complex root canal system, for irrigation and obturation (Gulabivala et al. 2005).

Root canal irrigants should be biologically compatible, chemically able to remove both organic and inorganic substrates, be antibacterial, demonstrate good surface wetting, have no adverse effects on remaining tooth structure and be easy to use and effective within clinical parameters (Gulabivala et al. 2005).

Penetration of irrigants in to the root canal is a function of irrigating needle diameter in relation to preparation size (Ram 1977), and placement of the needle closer to the working length increased the efficiency of irrigation (Abou-Rass & Piccinino 1982, Sedgeley et al. 2005).

Improvement of the efficiency of irrigation especially in the apical third of the root canal system has been attempted by agitating the irrigant. The use of hand-files, pumping of well adapted GP cones (manual dynamic), continuous irrigation during rotary instrumentation and sonic and passive ultrasonic devices have all been described (Gu et al. 2009).

Richman first described the use of ultrasonics in endodontics in 1957. Endosonics was a term first described by Martin and Cunningham (1984) and referred to the simultaneous preparation and irrigation of root canals. Passive ultrasonic irrigation (PUI) was first described by Weller et al. (1980) and relates to the non-cutting action of the ultrasonically activated file. The free movement of the file or wire allowed irrigant to penetrate more easily into the apical part of the root canal (Krell et al. 1988).

However significant problems were encountered with k-files as they produce irregular shapes and apical perforations (Stock 1991, Lumley et al. 1992), straightened canals (Chenail & Teplitsky 1985, 1988) and ledged simulated root canals (Al Jadaa et al. 2009).

Irrisafe™ (from Acteon UK) is a stainless steel instrument that is non-cutting, parallel sided and available in two lengths (21 and 25mm) and two tip sizes (ISO 20 and 25) and designed to be used after root canal shaping is complete to agitate freshly delivered irrigants.
It can be pre-bent in curved canals and introduced to 1mm short of the working length. It should fit loosely within the prepared canal shape so that the movement of the irrigant around the tip is uninhibited and the tip can vibrate freely. Once inserted, the power is activated and the violent movement of the irrigant "scrubs" the walls of the canal thereby implying the effective removal of dentine debris, micro-organisms (biofilm and planktonic bacteria) and organic tissue from the root canal (van der Sluis 2007).

The technique requires that the NaOCl irrigant is delivered in 3ml boli via a syringe fitted with a side vented needle and then Irrisafe™ is inserted and activated for 20 seconds. This is repeated three times. In oval canals the tip can be moved towards the walls (avoiding contact dampening) to encourage fluid movement into these areas.

Ideally EDTA liquid is then inserted and agitated for a further 20 seconds before a final flush of NaOCl is performed.

The canal(s) can then be dried and obturation carried out according to preference.

The results of the study

The mean percentage change in cross-sectional area and diameter in descending order were:
- Group 2 - 52.7 per cent and 26.2 per cent;
- Group 5 - 42.6 per cent and 25.8 per cent;
- Group 4 - 23.2 per cent and 9.4 per cent;
- Group 3 - 14.6 per cent and 5.1 per cent;
- Group 1 - 6.5 per cent and 3.8 per cent.

Linear regression analysis of the data from Groups 1, 2 and 4 revealed that canal dimensions were significantly affected by irrigant regime (p=0.0001), corono-apical level (p=0.009) and duration of irrigant agitation (p<0.0001). Analysis of the data from Groups 3, 4 and 5 revealed that both corono-apical level (p=0.009) and duration of agitation of the irrigant (p<0.0001) significantly affected the increase in canal dimensions.

Conclusions

The test model established that there is a clinically insignificant change in root canal dimensions when manufacturer's instructions were followed (Group 4). Irrigant choice and combination, duration of agitation and corono-apical level all had a significant effect on the dimensions of the artificial root canal.

Key features of IrriSafe

- Driven by the Newtron® range of piezoelectric generators, IrriSafe™ generates micro-cavitation and micro-currents that spread through the canal system. It is the best instrument for the passive ultrasonic irrigation currently available.
- The irrigant effect is amplified not only by the mechanical activation provided by the vibration, but also by the heating effect of the ultrasonics, that intensifies the sodium hypochlorite dissolution and debridement properties.
- Non-cutting edges to prevent any damage to the root canal anatomy.
- IrriSafe is more efficient than smooth wires, because its loops generate turbulences and optimise the irrigant activation.
- The blunt-end prevents any perforation to the apex or to the canal walls.
- The special steel benefits from a specific surface treatment that provides the instrument with a better resistance and transmission of the ultrasonic vibrations and a complete compatibility with sodium hypochlorite, versus nickel-titanium ultrasonic wires.

Godfrey Cutts and I run an annual two-day endodontic re-treatment course, throughout which we also use Acteon’s Endo Success Kit. This ultrasonic tips kit has been designed as a solution for the problems most often encountered during non-surgical endodontic treatments. The new titanium-niobium alloy allows optimum use of ultrasound in the trickiest situations. The current trend in surgical techniques is to offer minimally- or even non-invasive protocols. By using an operating microscope, together with high-tech micro-instruments, it is now possible to treat the entire root canal.
Re-treatment case study

Author: Godfrey Cutts

A 40 year old male referred by his own dental practitioner for endodontic treatment to tooth 16. History of intermittent pain and occasional swelling buccally.

Upon examination there was a full gold crown present, draining buccal fistula and the tooth was slightly tender to percussion. Radiographic examination (Fig 1) revealed existing endodontic treatment obturated with three silver points present, one in the mesio-buccal canal, one in the palatal canal and the third possibly inserted through a perforation of the pulp chamber floor. The disto-buccal canal had not been treated.

The patient could not recollect having endodontic treatment and it was presumed that it was long standing.

The treatment options, procedure and prognosis were discussed with the patient who then opted for re-treatment.

At appointment one a small dose of local anaesthetic was administered and the tooth isolated with rubber dam. The crown and amalgam core was then removed which revealed that the roof of the pulp chamber was almost intact (Fig 2) and the silver points were visible. Using a non-endcutting bur to remove the roof of the pulp chamber provided access to the pulp chamber. The silver points could now be seen clearly and were removed with Steiglitz, which allowed a considerable volume of pus to escape from the canals (Fig 3). There was not a perforation of the floor of the pulp chamber and in fact two silver points had been inserted into the palatal canal.

To locate the entrance to the disto-buccal canal the floor of the pulp chamber was gently explored using the ETBD (Fig 4) instrument from the Satelec EndoSuccess kit. Once the canal was located (Fig 5) and working lengths established with the apex locator all the canals were instrumented to ISO25 #06 taper. Copious irrigation with three per cent sodium hypochlorite was used during instrumentation.

Upon completion of canal shaping passive ultrasonic irrigation (PUI) with the Satelec “Irisafe” (Fig 6) instrument is carried out. This instrument creates micro-streaming (Fig 7) within the canal which has a cleaning effect and aids removal of debris. The protocol for this treatment is to flood the canals with three per cent NaOCl, insert the Irisafe to within 1mm of working length and activate the instrument for 20 seconds in each canal.

The irrigant should then be replaced and the procedure repeated three times. This is followed by a one minute soak with 17 per cent EDTA liquid with a final rinse with three per cent NaOCl.
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The canals were the dried thoroughly and a calcium hydroxide dressing (Ultracal) placed in all the canals and temporised with GIC.

At appointment two one week later the buccal fistula had healed so the tooth was isolated with rubber dam. The canals were accessed, the calcium hydroxide removed and further PUI carried out. Since the canals could be dried obturation with Kerr root canal sealer EWT and GP using thermal downpack was carried out followed by a bonded amalgam core. A temporary crown was then provided and the patient returned to the referring dentist.

The post-operative radiograph (Fig 8) shows the canals obturated to length.

Fig. 4

Fig. 5

Fig. 6

Fig. 7

Fig. 8

Godfrey Cutts qualified from The Sutherland Dental School, Newcastle-upon-Tyne in 1961 and has practised in Nuneaton since 1964. In 1998 the practice was sold to Oasis Dental Care Ltd and he became Clinical Director, Clinical Adviser and was involved in the acquisition of practices. For the past eight years he has taken referrals for endodontic treatment, re-treatment and apical microsurgery. He spends two days a week entirely devoted to endodontics and has completed some 400 cases a year. In conjunction with Davis Schottlander & Davis Ltd, he runs regular hands-on courses around the country for general practitioners on the use of specialist Ni-Ti rotary instruments and current endodontic techniques to improve their general treatment outcomes. In 2005, he filmed and produced an instructional DVD on the use of „RaCe“ Ni-Ti instruments and has more recently been involved with the evaluation of a new instrument from Satelec for ultrasonic micro-streaming cleaning of root canals. He believes this will become the gold standard in future endodontic treatment protocols. He is passionate about further developing endodontic treatments to improve the outcome for patients. www.gcutts.co.uk
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Persistent apical periodontitis (AP) refers to AP that is associated with a tooth that has had root canal therapy (RCT). As with primary AP, bacteria are the most common cause of the inflammatory response.

Previously, a large body of evidence indicated that persistent infections are commonly composed of a single species; however, recent evidence points to the presence of a mixed biofilm. There are also nonmicrobial causes of AP, including foreign-body reactions, cystic formation, endogenous cholesterol crystals and scar formation.

The microbes that cause persistent AP are more commonly located intra-radicularly (inside the root). Occasionally, these microbes will also be located extraradically. We will discuss the far more common intra-radicular microbes first.

Intra-radicular microbes

The key study referenced on the presence of microbes within the root in cases of persistent AP is Nair et al. When considering the cause of the persistent infection, consider that the microbes were either present prior to RCT being initiated (primary infection) or they entered during or after treatment (secondary infection). In considering those microbes that have survived from the primary infection, consider how they might have achieved this. They may have been resistant to the chemicals used in the disinfection process (Enterococcus faecalis, for example, has some mechanisms to survive calcium hydroxide), or they may have been located in a portion of the canal that was not instrumented nor cleaned via chemical means.

Regarding secondary infection, these microbes may have gained access to the canal during treatment or after treatment. Consider that they may have been carried into the canal on a contaminated instrument or perhaps a leaking rubber dam may have allowed saliva to contaminate the root canal.

Alternatively, a poorly placed temporary restoration may have allowed leakage into the root-canal system in-between visits. If caries has not been completely removed, or a previous restoration subject to microleakage is left in place, then this can also be a source of secondary infection. Alternatively, these microbes may have entered a previously clean root-canal system after the completion of RCT. This could be due to a leaking restoration, or through caries or a crack in the tooth. It is important to understand the microbial nature of AP, and to have this foremost in our minds when undertaking treatment.

Which microbes are present in persistent AP caused by secondary infection?

When we examine the composition of the infection in AP, we find a significantly different microflora than that found in primary infections. Generally in persistent AP, there are only one to five species. These are predominately Gram-positive and there is an equal amount of obligate and facultative anaerobes. Owing to the fact that obligate anaerobes are easier to kill, it may be that facultative anaerobes are more likely to persist within the root-canal system after treatment.

E. faecalis and Candida albicans

E. faecalis is an opportunist pathogen implicated in many general surgery postoperative infections. It
has been identified as an opportunistic pathogen in persistent AP in a number of studies. This particular microbe has been studied extensively.

It possesses a proton pump on its cell membrane, which allows it to regulate its internal pH. This means that it is resistant to calcium hydroxide and this may be one of the ways that it survives and becomes implicated in persistent infections.

It is also able to survive by itself and without nutrition for long periods. It is rarely found in untreated canals. C. albicans (a fungus) is also found more commonly in persistent infections than in primary infections.

Extra-radicular infections

Occasionally, we may find a situation where microbes establish themselves outside the root-canal system. The microbes may establish themselves on the external root surface in a biofilm, in association with infected dentine chips that have been displaced into the periapical region, or within a periapical cyst. These microbes must be able to withstand the body’s attempts to kill them and it is likely that biofilm formation allows this. Similarly in the periapical cyst situation, it is the cyst itself that protects the microbe from the immune response.

In particular, two microbes have been implicated in extra-radicular infections. These are Actinomyces species and Propionibacterium propionicus. These microbes are able to form cohesive colonies within an extracellular matrix. This helps them to avoid phagocytosis and so continue to survive and invoke the immune response.

Non-microbial causes of AP: Cysts, foreign-body reactions and cholesterol crystals

In some cases, AP may not be maintained by microorganisms. I say "maintained", because often the AP is initially caused by microbes, and after endodontic treatment, one of the following factors takes over, maintaining the immune response and thus AP. Periapical cysts are an interesting topic. There are a range of studies that attempt to measure the incidence of periapical cysts in examined periapical lesions. In simple terms, the lesion is biopsied and then examined under a microscope. If an epithelial-lined sack is found, then the lesion is designated a cyst. But in 1980, Simon published a paper, which included serial sectioning of periapical lesions. What he found was that some lesions that appeared as cysts on one section, appeared differently on other sections. Thus, it was deemed that the majority of studies (which did not use serial sectioning) relating to the prevalence of cysts were subject to error. If one just takes a random slice, the effect in two dimensions may be that of a cyst, when in reality the full 3-D structure of the cyst does not exist.

Nair studied far more lesions than Simon, and found that 15 per cent could be classified as cysts (including both true and pocket varieties). This is probably the best figure to quote. Other studies report figures from five to 55 per cent, but they failed to use serial sections.

It is also important to realise that a large proportion of abscesses and granulomas will also contain epithelium. In Nair’s study, 52 per cent of the lesions were epithelialised, but only 15 per cent were cysts. It is likely that the inflammatory process results in the proliferation of this epithelium and, over time, the epithelium develops into a cyst.

Nair contends that these two types of cysts are quite different. He feels that the true cyst is self-sustaining and will remain independent of efforts to remove the micro-organisms from the root-canal system. The pocket cyst, on the other hand, is maintained by the microbes within the canal system. Removal of the microbes, which are maintaining the
Clinical apical periodontitis

inflammatory response, may allow the pocket cyst to heal. In reality, it will be very difficult to prove or disprove this theory, but one could say that it makes sense.

Foreign-body reactions

When exogenous materials are located in the periapical region, they can induce and maintain an inflammatory response, which may be asymptomatic, but will be seen as a radiolucency. Materials may be gutta-percha, amalgam, sealants, calcium hydroxide or cellulose fibres, such as those contained in paper points.¹

In practice, these lesions are rarely seen but have been reported in the literature, so it is important to understand that this mechanism for the maintenance of AP does exist. It also reminds us to be careful when using paper points and not to extend them into the periapical areas, as human cells cannot degrade cellulose and leaving fibres behind may result in a foreign-body reaction.

Gutta-percha may also induce a foreign-body reaction, especially in fine particles.¹⁸ Overextended gutta-percha may, as a result, cause delayed healing of periapical tissue.

Cholesterol crystals

Cholesterol crystals are also seen in AP, and are probably released by disintegrating erythrocytes, lymphocytes, macrophages and plasma cells, as well as from circulating plasma lipids.¹⁹ These collections of cholesterol are referred to as cholesterol clefts and induce a reaction similar to a foreign-body reaction as the macrophages and giant cells are unable to remove the cholesterol. Again, this may result in a non-healing lesion, despite well-completed endodontic treatment.

The Endospot easy study guide to persistent AP

A Persistent AP is most commonly caused by microbes remaining within the root-canal system.¹

B It appears that a mixed biofilm may be responsible, contrary to the previous belief that usually only one microbe was responsible.¹

C The microbes are either:⁵
  i) Primary — remained within the canal from the initial infection; or
  ii) Secondary — entered during or after treatment.

D Persistent AP shows significantly different flora to primary AP:³
  i) one to five species per canal
  ii) predominately G+
  iii) equal number of obligate and facultative anaerobes

E E. faecalis—opportunist pathogen that has been identified more commonly in persistent AP:¹
  i) possesses a proton pump, which allows it to survive in high pH (that is it can survive calcium hydroxide)
  ii) can survive in mono-infection;
  iii) can survive long periods of low/no nutrition

F C. albicans also found more commonly in persistent infections than in primary.¹⁰

G Extra-radicular infections can occur in biofilm on the root tip,¹³ or in the periapical area itself:¹⁴
  i) P. propionicus and Actinomyces species are able to form adhesive colonies in an extracellular matrix in the periapical tissue.

H Non-microbial causes of AP are:
  i) periapical cysts (15 per cent of lesions)¹⁶—serial sectioning indicates two types: true cysts and pocket cysts
  ii) foreign-body reactions
  iii) cholesterol clefts

Editorial note: A complete list of references is available from the publisher.

Dr Patrick Caldwell is a registered specialist in Endodontics. He graduated in dentistry with honours from the University of Queensland in 1998 and then went on to work for the Royal Australian Navy, both ashore and at sea. During this time, he undertook advanced training in restorative dentistry and in 2002 sat examinations and was elected a Fellow of the Royal Australasian College of Dental Surgeons. In 2003, Dr Caldwell began a three-year, full-time training programme in root-canal therapy, and graduated with a Master of Dental Science in Endodontics at the end of 2005. He is involved in teaching at the University of Queensland and has conducted courses both nationally and internationally to help general dentists improve their root-canal skills. Dr Caldwell runs The Endospot, a blog at www.endospot.com, and can be contacted at reception@bmendodontics.com.au.
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CBCT study of root canal morphology of mandibular first molars in a Spanish population

Authors: Drs Óliver Valencia de Pablo, Jose María Abadal, Roberto Estévez, Federico Moreno-Sancho, Teresa Pérez-Zaballos & Manuel Péix Sánchez

The objective of root canal treatment is the rigorous mechanical and chemical cleaning of the entire pulp cavity, its 3-D obturation with an inert material and the achievement of an appropriate hermetic coronal seal to prevent micro-organism intrusion. Microorganisms are the most important aetiological factor for pulp and peri-apical pathology. Pulp tissue not completely removed from the root-canal system is the main reason for failure of endodontic treatment in molars. The cause of failure is the infection of the remaining tissue, which is either already or subsequently infected by microorganisms. This problem seems to be aggravated by the presence of root canals unnoticed by the clinician, coinciding with anatomical variations or additional canals. In fact, the lack of knowledge about root canal anatomy has been identified as one of the most common reasons for endodontic failure.

The mandibular first molar (MFM) is the most frequently endodontically treated tooth. Furthermore, it is the tooth with the greatest rate of endodontic failure. The relative simplicity and uniformity of the external surfaces of its roots quite often mask the internal complexity. Generally, the MFM is described as having three canals, two in the mesial and another in the distal root. Recent studies demonstrate the possible presence of three canals in any of the roots.

Various methods have been employed to study the internal anatomy. The best-known and most frequently used method in the literature is achieving transparency of the roots. In recent years, 3-D imaging technology has been introduced and cone-beam computed tomography (CBCT) in particular is starting to prove very valuable in dento-maxillofacial imaging.

CBCT is a useful tool in implant dentistry, for identifying anatomic structures and for the evaluation of periodontal lesions, as well as many other applications.

With regard to endodontics, Cotton et al.
described a number of cases in which CBCT was the definitive diagnostic tool used. In these cases, CBCT showed an MFM with an extra root that had not been diagnosed or treated initially. However, only a few studies have used this modern diagnostic technique to analyse canal configuration. Various researchers have used CBCT to evaluate maxillary molars. CBCT has also been used to determine the number and the morphology of the roots of mandibular molars in patients.

The following is the first in-vitro study to use CBCT technology to determine the configuration and morphology of the canal system of the permanent MFM.

Materials and method

In collaboration with various Spanish National Health Service centres, 53 permanent MFMs were collected. The age and gender of the patients were not known. Before extraction, the dentist confirmed that the teeth to be extracted were MFMs, relying on their position within the lower arch. Afterwards, this was corroborated through the coronal anatomical analysis of the samples. After extraction, all samples were cleaned and stored in 10 per cent formaldehyde. All samples were submerged in four per cent NaClO to dissolve any remaining organic tissue. Manual curettes and ultrasonic scalers were used to dissolve any calculus that remained on the root surfaces.
In order to locate and secure the samples within the bite holder of the CBCT device, they were embedded in plasticine. The scanning was carried out by an expert radiologist, who had experience using CBCT.

The device used for the purposes of this survey was the i-CAT (Imaging Sciences International) with a voxel size of 0.2mm and a grey scale of 14 bits. Owing to the characteristics of the CBCT, the position of the samples during scanning did not matter. The entire volume was registered, not only the volume that falls within a determined area as would be the case using conventional techniques. Therefore, we were able to study the results in any of the spatial planes. All the samples were positioned starting with the mesial root followed by the distal.

Once the 3-D images of every sample had been processed, the data was analysed with i-CAT Vision software (Imaging Sciences International), which offers various views of the data. We used the multiplanar reconstruction screen, as it allowed us to analyse the images in slices for the three different spatial axes. In addition, the screen showed a simultaneous interaction amongst the axes, allowing the operator to rotate the inclination of the sample in a way that allowed the observation of the curvature of each root through independent axial slices.

The canal configurations observed in the samples were grouped based on Vertucci’s classification.28 (Since 1984, different configurations to the ones described by Vertucci have been proposed.) Table I shows a schematic representation of the different types of canal systems that are present in the roots of the permanent MFMs as given in the literature.

### Results

The results of the total number of canals found, the canal configurations in the mesial root and the canal configurations in the distal roots are shown in Tables II, III and IV. Figure 1 shows examples of the slices from the molars, illustrating the number of canals. Figure 2 shows examples of the different configurations found in the mesial root, while Figure 3 shows examples for the distal root.

### Discussion

A literature review found that the number of canals in the MFM varies and that there are differences between the findings of in vitro and in vivo studies in this regard. We suggest that modifications of the access cavity and clinical effort to locate the canals may be a possible

---

**Table I** Configuration possibilities of mandibular MFM roots according to the literature

<table>
<thead>
<tr>
<th>Vertucci 1984</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1: 1-1</td>
</tr>
</tbody>
</table>

**Table II** Number of canals in MFMs

<table>
<thead>
<tr>
<th>Number of canals</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of molars</td>
<td>22</td>
<td>14</td>
<td>15</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Incidence in %</td>
<td>41.5</td>
<td>29.4</td>
<td>28.3</td>
<td>1.9</td>
<td>1.9</td>
</tr>
</tbody>
</table>
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explanation for these differences. The calcification of the coronal portion of the canal often does not permit adequate access to the root and canal morphology, but this does not mean that it has disappeared. The calcification always follows a corono-apical direction. Therefore, the most complicated part for a clinician is to identify the entrance to the canal. However, once this has been achieved, instrumentation is usually simple. Thanks to CBCT, it is possible to observe axial slices of roots of any given height, allowing us to count the number of canals independently of the coronal access.

Initially, we know that both the mesial and the distal root have just one canal and the dentine apposition inside them develops a canal system. On some occasions, we were able to find up to four different divisions at a given height. Clinically, it is extremely difficult not only to detect their existence, but also to access them with either manual or rotary instruments.

In fact, when four canals were observed within a root, the divisions between them were so tiny that they disappeared after the instrumentation of the main canals, resulting in a simpler “prepared” anatomy. The above-mentioned facts may explain the lower number of canals found in the literature compared with the results obtained in our investigation. We obtained similar results to Forner Navarro et al. for the number of canals in the mesial root of the MFM using CT. In two different in vitro studies, they found the frequency of three canals within the mesial root to be 14.8 per cent and 12 per cent. We obtained a rate of 17 per cent in our study, which made us question the validity of other methodologies. Further analysis of the 3-D technique is necessary. In our opinion, the main advantage of the technique is that it does not alter the structure of the samples in any way.

A recent publication confirmed the aforementioned data. In the study, 48 access cavities were prepared in vitro and modified in the mesial root of MFMs. The pulp chamber was explored with a microscope and ultra-sonic tips. The operator observed the presence of a middle mesial canal in nine roots (18.7 per cent). This confirms that the proper elimination of calcification and coronal interferences allows access to a greater number of canals in the mesial root of the MFMs.

We obtained similar results to Forner Navarro et al. for the number of canals in the mesial root of the MFM using CT. In two different in vitro studies, they found the frequency of three canals within the mesial root to be 14.8 per cent and 12 per cent. We obtained a rate of 17 per cent in our study, which made us question the validity of other methodologies. Further analysis of the 3-D technique is necessary. In our opinion, the main advantage of the technique is that it does not alter the structure of the samples in any way.

The literature shows that Types II and IV of Vertucci’s classification of the canal system configuration are the most frequent in the mesial root. In our study, 39.6 per cent of the mesial roots — compared with 35 per cent in the literature — showed two canals that were linked in the apical third, a close correlation. In our study, the Type IV configuration — two independent canals — was less frequent (39.6 per cent)

---

**Table III. Mesial root canal system configuration**

<table>
<thead>
<tr>
<th>Number of mesial roots</th>
<th>22</th>
<th>21</th>
<th>2</th>
<th>1</th>
<th>3</th>
<th>3</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidence in %</td>
<td>39.6</td>
<td>39.5</td>
<td>3.8</td>
<td>1.9</td>
<td>5.7</td>
<td>5.7</td>
<td>1.9</td>
</tr>
</tbody>
</table>

---

**Table IV. Distal root canal system configuration**

<table>
<thead>
<tr>
<th>Number of mesial roots</th>
<th>25</th>
<th>3</th>
<th>10</th>
<th>2</th>
<th>1</th>
<th>4</th>
<th>1</th>
<th>2</th>
<th>2</th>
<th>1</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidence in %</td>
<td>47.2</td>
<td>5.7</td>
<td>18.9</td>
<td>3.8</td>
<td>1.9</td>
<td>7.5</td>
<td>1.9</td>
<td>1.9</td>
<td>3.8</td>
<td>1.9</td>
<td>1.9</td>
</tr>
</tbody>
</table>
compared with the literature (52.3 per cent). The presence of three independent canals was only seen in one case, but other complex configurations, such as 3-2-1, 2-3-2 and 3-1-2, were found, raising the number of mesial roots with three canals to nine.

The configuration of the canal system of the distal root offered more variety. The frequency of a single canal (47.2 per cent in our data compared with 62.7 per cent in the literature) was lower, increasing the number of cases involving more complex configurations.

This is probably due to a higher rate of calcification in the canals in our samples. Most of our samples were extracted owing to large decay lesions, defective and not repairable restorations or coronal fractures, with a considerable number showing clear signs of prolonged chronic bruxism. All these factors enhance the apposition of dentine on the inside of canals, creating subdivisions of the main canal. We found three configurations not yet described in the literature:

1-3-2: Initially, we observed a single canal, which rapidly diverged into three. Towards the middle third of the root, two canals joined to finish with two different canals in the apical third.

2-3-2-1: One of the roots showed two canals that later divided into three. Towards the middle third, two of them joined together and all of them finished in the same common foramen.

2-4-3-1: In another distal root, we found the most complex of all configurations in either a distal or a mesial root. Two canals divided into four, fusing afterwards into three and finally joined together to finish at the same foramen.

Another difference between our results compared with the literature regarding the distal root was the low frequency of the Type II configuration (5.7 per cent compared with 14.5 per cent), which is in contrast with our findings for configuration Type III. The explanation seems to be simple: the results of in vitro studies were consistently similar to our results, while the results of in vivo studies were not. The problem is that when a canal divides into two towards the middle third, the only way to fill it is by instrumenting the canal to enlarge the coronal portion, allowing direct access to each of the canals. The consequence is that clinically all Type III canals (1-2-1) become Type II canals (2-1) after root-canal treatment has been completed.

Given the amount of information provided without altering the samples, CBCT technology is a great aid for the in vitro evaluation of the root-canal anatomy of the permanent MFM. Michetti et al. compared CBCT slices with histological sections to determine the appearance of the second mesiobuccal canal in maxillary molars. They found no significant differences.22

Neelakantan et al. compared CBCT to four different methods for the study of the morphology of the root canal system. Their results of CBCT were similar to those obtained using a clearing technique, which is considered the gold standard for this kind of study.33

The radiation a patient has to endure depends directly on the volume to be scanned, which makes in-vivo analysis using CBCT a clinical possibility.19 In fact, the literature review has shown, that CBCT is a very valuable and useful tool in obtaining a satisfactory treatment outcome.34,35

Conclusion

It has been shown that CBCT is a useful and valid tool for in vitro evaluation of the morphology of the root-canal system of the permanent MFM. The most frequent configurations for the mesial root were 2-1 and 2-2, but a high percentage of roots (17 per cent) had three canals. Half of the distal roots had only one canal, but the other half had diverse configurations, with 1-2-1 the most frequent configuration. The CBCT results obtained in this study also demonstrated more complex configurations, such as 1-3-2, 2-3-2-1 and 2-4-3-1, which have not been previously described in the literature.
The vital amputation (VA) of deciduous teeth with the goal of maintaining their functionality for a limited period is a widely accepted measure. Vital amputation of permanents, however, is only approved for limited indications. While therapeutic agents such as calcium hydroxide (Ca(OH)2) and mineral trioxide aggregate (MTA) are recommended for VAs, formaldehyde (CH2O) containing agents are a controversial subject.

The European Society of Endodontology (ESE) defines pulp amputation as a procedure during which part of the exposed vital pulp tissue is removed with the aim of maintaining vitality and function of the remaining parts of the pulp. ESE recognises the following indications for VAs:

1. treatment of deciduous teeth
2. treatment of permanents with incomplete root growth
3. emergency measure

Indications 2 and 3 include the option of a later definitive root-canal treatment (RCT). Seidler recommends VA for the accidentally opened pulp of young molars and extremely curved, narrow root canals. Stern considers difficulty in opening the mouth an indication for VAs as well. McDougal et al. extend the indication for pulpotomy when there are economic concerns, as some patients are unable or unwilling to bear...
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the expense of a RCT. According to Swift et al., a successful VA may be expected following traumatic or mechanical carious pulp exposure. We consider predictable success with the following prerequisites:

- non-inflamed pulp
- bacteria-proof closure
- use of a pulp-compatible capping material

Seidler states the following regarding the success of VA:

- A higher rate of success is observed in cases of iatrogenic pulp exposure
- Treatment success is reduced in cases of complete root growth
- Molars are more successfully treated than incisors

For a pulpotomy with Ca(OH)2, Jensen presupposes that there is no pain existent anamnestically. Teixeira et al. corroborate the significance of pain prior to VA in their study of 41 Ca(OH)2 vitally amputated permanent teeth, anamnestic pain existed in 12 cases. The pulpotomy of these aching teeth led to failure after six to eight months in 50 per cent of the cases (n = 6), while all other vitally amputated teeth were considered successfully treated. McDougal et al. report on 73 eugenol pulpotomies on aching permanent molars and premolars. A clinical success rate of 90 per cent after six months and 78 per cent after 12 months was observed. The teeth, which were free of pain at check-up, were radiologically controlled and it was shown that 49 per cent of the teeth were free of pathological findings after six months and 42 per cent after 12 months.

According to Jensen, pulpotomy is an attempt to stimulate hard tissue healing at the area of amputation. Fountain and Camp point out that a pulpotomy may result in canal calcification, internal resorption or necrosis of the pulp. Kozlow and Massler refer to literature that reports the formation of a dentine bridge in rat teeth under non-calcium-containing materials, such as wax, amalgam, acrylic resin and zinc oxide eugenol. In human teeth, the bridging under Ca(OH)2 was successful in 43 per cent of the cases and under antibiotics in 23 per cent of the cases. During their own tests on rat teeth, the authors assessed good reparative reactions with complete bridging following pulpotomy with Ca(OH)2, zinc oxide eugenol, cortisone and silver amalgam.

According to Alacam, various materials are recommended for pulpotomy: Ca(OH)2, formocresol, glutaraldehyde, ferrous sulphate, zinc oxide eugenol and polyacrylic cement. Salako et al. compared MTA, formocresol, ferrous sulphate and bio-active glass with regard to their pulpotomy compatibility and found MTA to be the ideal pulpotomy agent.

Agents that contain CH2O and Ca(OH)2 are historically established VA agents for deciduous and permanent teeth. Massler et al. report a clinical success rate of 92 per cent following VA with Ca(OH)2. Taking postoperative X-rays into account, the success rate was reduced to 75 per cent after one year and dropped to 65 per cent after two to five years. The authors suggest several reasons for this failure:

- pulp already heavily inflamed initially
- too much pressure applied during application
- disposal of the blood coagulum via haemostatic agents

Mejàre and Cvek performed partial pulpotomies using Ca(OH)2 on 37 permanent teeth (35 molars, two premolars). The patients were six to 15 years old and their pulpotomy had to be performed at least two years prior to inclusion in the study. Check-ups were performed at an average of 56 months (24 to 140). The teeth were separated into two groups (Table I). Two failures occurred in the first group, in teeth with incomplete root growth (after ten days and 48 months). The other 29 teeth (93.5 per cent) were treated successfully. In the second group, two failures occurred (after 10 and 24 months)

| Table I |
|---|---|
| **1st group (31 teeth)** | **2nd group (6 teeth)** |
| (no pathological findings radiographically, no anamnestic pain) | 3 with periodontal gap enlargement |
| 17 teeth with complete root growth | 2 of them with pain |
| 14 teeth with incomplete root growth | 3 with apical ostitis |
| | 5 teeth with complete root growth |
| | 1 tooth with incomplete root growth |

Table I

34 / roots 2012
The only control system offering the pre-programmed clinical sequences of the main implant brands is now available with a dedicated application for touchscreen tablets.

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Molven states that there were no pathological findings in 1,391 root-filled roots in 51.6 per cent of the cases and in 236 pulpotomized roots in 65 per cent of the cases.14 Asgary and Eghbal report the successful use of a new VA agent called CEM, a cement mixture enriched with Ca, in 205 pulpotomies on molars.15 For comparison, 202 molars were extirpated vitally. The root-canal filling (RCF) was performed via lateral condensation with AH Plus (DENTSPLY DeTrey) as sealant. After seven days, 38 per cent of the pulpotomy treated and 60 per cent of the root-canal-treated patients reported needing analgesics. After six months, 88.94 per cent of the patients underwent a radiological check-up. The pulpotomy patients revealed a significantly higher success rate (p < 0.001).

The most frequently used VA agent for deciduous teeth is formocresol, a mix of CH2O, cresol, glycerine and water. A survey showed that formocresol pulpotomies on deciduous teeth were performed by general dentists in 73 per cent of the cases and by paediatric dentists in 98.2 per cent of the cases.16 The frequency of use on permanent teeth was lower: 18.9 per cent for general and 55.4 per cent for paediatric dentists.

Fisch published the results of pulp amputations of 600 teeth, which were performed with the CH2O-containing preparation Triopaste.17 Check-ups were done between six months and 18 years after amputation. Examination of the X-ray controls revealed a pathological apex in nine per cent. Eleven teeth were histologically examined. Hard substance formation was observed in the form of apical foramen closures and apposition at the lateral canal walls, which partially led to obliteration of the canal lumen.

During an accelerated test lasting up to 2.5 months, Overdiek tested N2 as CH2O-containing VA agent on human teeth. He observed that for several weeks following N2 application there was a possibility of a hard substance barrier forming.18 Over a period of 12 years, Stern3 carried out 175 N2 pulpotomies under relative isolation on teeth with complete root growth, regardless of possible anamnestic pain. Fifteen per cent of the patients experienced increased pain after treatment, which subsided within 48 hours. Four patients, however, developed pulpitis, which re-
sulted in the extraction of three teeth and con-
servative RCT of one tooth. Stern was able to
track the outcome of 35 vitally amputated teeth
over a longer period. During the course of check-
ups, two teeth were extracted, one of them due
to a fracture. Five years after treatment, Stern
observed advancing calcification of the nerve
channels.

Frankl considers the advantage of pulpotomy
compared with RCT as there being no instrument
fractures or perforations during pulpotomy.\textsuperscript{19} A
possible failure could always be countered with a
RCT. He asserts that Ca(OH)\textsubscript{2} pulpotomies can be
successful only if teeth are asymptomatic prior
to treatment and for accidentally opened pulp
and, therefore, bleeding from the pulp.

According to the literature, N\textsubscript{2} VA on decidu-
ous teeth renders significantly better results than
Ca(OH)\textsubscript{2} pulpotomy. Therefore, Frankl performed
N\textsubscript{2} pulpotomies on permanent teeth as well.\textsuperscript{19,20} He
selected only asymptomatic teeth whose pulp
had been accidentally exposed for treatment. The
treatment was performed under a rubber dam
and thus pulp bleeding did not have any effect.
Two hundred and fifty cases were re-examined
for up to 13 years. The age of the patients ranged
between 22 and 55 years. Failures manifested by
pain within 48 hours amounted to two per cent.
The aim of the following study was to analyse
the success and failure rates of N\textsubscript{2} VAs on per-
manent molars, and to compare these rates with
vital molar extirpations done within the same
period.

Material and method

The study was conducted in my dental practice,
which is located in a rural area. Between 1992
and 1998, 795 VAs and 945 vital extirpations
(VEs) were performed on molars. After treatment,
85 VA and 93 VE patients did not return to the
practice and were thus excluded from the study,
leaving 710 VAs and 852 VEs for analysis. Dur-
ding the treatment period, only N\textsubscript{2}, which was
approved by the district president of Düsseldorf,
Germany, on 8 February 1990, was used as ther-
apeutic agent (see Table II for composition).

The root canals were prepared according to
the N\textsubscript{2} method: relative isolation, no root-canal
rinsing and root-canal preparation with reamers
only.\textsuperscript{21} For the RCF, N\textsubscript{2} mixed to a creamy consis-
tency was applied with a lentulo spiral. The VA
cavities were prepared 1 to 2mm into the canals.
N\textsubscript{2} mixed to a paste was inserted into the cavity
with a filling instrument and lightly pressed with
cotton. Minor bleeding was irrelevant.

In cases of heavier bleeding, the inserted N\textsubscript{2}
was removed after a few minutes and then re-
placed with freshly mixed N\textsubscript{2}. A synthetic clo-
sure of the cavity performed within the same
sitting required a lining, which is not necessary
for an amalgam closure. X-ray controls were
later viewed at double and sevenfold magnifica-
tion. The apical condition was differentiated as
follows: apically without pathological findings,
apically uncertain and apically pathological. The
root with the worst apical findings was evalu-
ated. This was also applicable for the classifica-
tion of RCF levels.

Failures without accompanying X-rays were
termed Mi1 and failures with accompanying X-
rays were termed Mi2. The total failure percent-
age was not determined by simply adding Mi1
and Mi2, but by adding the number of Mi1s to
the number of X-rays taken. The percentage of

<table>
<thead>
<tr>
<th>Tooth</th>
<th>Σ</th>
<th>Recall</th>
<th>Extraction</th>
<th>X-ray post VE</th>
<th>Failure</th>
<th>V</th>
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<td>152</td>
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<td>6</td>
<td>21.4</td>
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<td>64.3</td>
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<td>852</td>
<td>90.2</td>
<td>123</td>
<td>14.4</td>
<td>495</td>
<td>58.2</td>
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</tr>
</tbody>
</table>
Results

Of the VA patients 47.6 per cent were male and of the VE patients 52.4 per cent were male. The practice owner treated 70.1 per cent \( (n=498) \) of the VA patients and 49.1 per cent \( (n=418) \) of the VE patients and all the rest were treated by an assistant. The average age of VA patients was 34.6 years and that of VE patients was 30.6 years. The average observation period was 53.8 months (max. 165) for VAs and 49.4 months (max. 169) for VEs. Of the 710 VA cases 504 (71 per cent) and of the 852 VE cases 496 (58.1 per cent) were subject to follow-up X-ray controls.

A total of 61 VA and 77 VE failures were registered and classified as without accompanying X-ray \( (\text{Mi1}) \) or with accompanying X-ray \( (\text{Mi2}) \). Fifty-one of the 61 VA failures were followed-up with X-rays. Not all of the accompanying X-rays of the Mi2 failures revealed a failure.

Two VA failure X-rays and ten VE failure X-rays were wrongly evaluated as negative. Ten VA Mi1 cases were removed because of pain, three of them within a few hours after VA.

In two cases, a granuloma at an extracted root was indicated in the patient files. In two additional cases, the extraction followed after six and 11 days. In 12 of the 16 VE cases, extractions were performed because of pain (one day to 21 months after VE). Patients who visited the practice after pulpotomy made positive a negative reference to anamnestic symptomatic pain 241 times and 157 times, respectively. Subsequently, the failure rate was 10.8 per cent \( (n=26) \) in the first case and 7.0 per cent \( (n=11) \) in the latter case. The difference was insignificant statistically \( (p = 0.114) \).

The failure diagnosis after VA was most frequently made for the lower second molar (18.5 per cent) and after VE for the lower first molar (19 per cent). The lower wisdom teeth were conspicuous because the failure rate was only 4.7 per cent after VA, and no failure at all was observed after VE. Not every failure diagnosis led to therapeutic consequences such as extractions.

Altogether, 206 (28.6 per cent) VA and 123 (14.4 per cent) VE teeth were extracted during the follow-up phase (very statistically significant difference; \( p = 0.000 \)). The largest number of extractions, namely 51.9 per cent \( (n=107) \) of the VAs and 46.3 per cent \( (n=57) \) of the VEs, were performed because the teeth had been destroyed or fractured. The lower wisdom teeth were the most frequently affected in the case of pulpotomy (61.8 per cent; \( n=21 \)) and the upper second molars in the case of VE (64 per cent; \( n=16 \)).

A failure was decisive for the removal of 23.3 per cent \( (n=48) \) of the extracted VA teeth and 36.6 per cent \( (n=45) \) of the extracted VE teeth. Most frequently extracted due to failure were the vitally amputated upper second molars (34.8 per cent; \( n=8 \)), and the vitally extirpated lower second molars (54.2 per cent; \( n=13 \)). The lower wisdom teeth (34 extractions \( (n=3; 8.8 \text{ per cent}) \) in the pulpotomy group) and the upper second molars (42 extractions \( (n=13; 31 \text{ per cent}) \) in the VE group) were extracted least often. The VE and VA results are shown in Tables III and IV.

<table>
<thead>
<tr>
<th>Table IV</th>
<th>Summarised VE results.</th>
<th>Table IV</th>
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<td></td>
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<td>X-ray post VA</td>
<td>Failure</td>
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<td>735</td>
<td>710</td>
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Furthermore, the question of whether the RCF level following VE had any significance with regard to the failure rate was pursued. The RCF levels were divided into three levels. The total failures of these three groups were calculated as described under material and method (Table V). Without considering the indication range, anamnestic symptoms, tooth position and RCF level, the total failure rate was 11.9 per cent for VAs and 15 per cent for VEs (statistically insignificant; p = 0.644). The VE failure rate of the RCF level of -4, -3 corresponded exactly to the VA failure rate of 11.9 per cent. There was no statistically significant difference (p = 0.226) in failure between RCF levels -4, -3 and -2, -1, 0. The RCF level of -5 showed significantly more failures compared with the RCF levels of -4, -3 (p = 0.020) and -2, -1, 0 (p = 0.002).

Discussion

A direct comparison between VAs and VEs, especially as regards incomplete root fillings, was only possible within limits, as the number of VAs consisted mainly of a negative selection, which otherwise would have been entrusted to the pliers. The twice as high extraction frequency of vitally amputated teeth compared with that of vitally extirpated teeth (28.6 per cent versus 14.4 per cent) may be attributed to the adverse baseline situation. Fractured or destroyed teeth were the reason for extraction for 51.9 per cent of all extractions in the case of VAs. For VEs, this rate was 46.3 per cent. However, the extraction reason "endodontic failure" was attributed in 36.6 per cent of the extractions to the VA teeth and in 23.3 per cent of the VE teeth.

Anamnestic pain causing an increased frequency of failure in VA cases, which was also observed by Teixeira et al. following Ca(OH)2 treatment, was statistically insignificant. Stern und Frankl also point out increased pain following VA. This was observable during our study as well. Nevertheless, the total failure rate for vitally amputated teeth was lower (11.9 per cent) than the average rate of 15.1 per cent for vitally extirpated teeth.

The evaluation of pulpotomy cases only with accompanying X-rays revealed a failure rate of 10.1 per cent, which is comparable to the nine per cent Fisch encountered with the Triopaste. Frankl reports only two per cent of failures af-
ter N2 VA, although he had done stringent case selection. In contrast, the radiological-pathological findings concerning eugenol pulpotomies in pain-free teeth amounted to 58 per cent after 12 months. Fifty per cent of all Ca(OH)2 pulpotomies of aching teeth resulted in failure after six to eight months. Massler et al. observed a total failure of 65 per cent, two to five years after Ca(OH)2 VAs.

The correlation between failure and RCF level following VEs was investigated. Adequately filled teeth (-2, -1 ad apicem) showed a failure rate of 8.9 per cent, heavily underfilled teeth a rate of 22.1 per cent. Hence, the conclusion may be drawn that the success rate of VAs corresponds to the one of properly performed root fillings following VEs, and is far superior to a noticeably underfilled root filling. Molven attributes a more favourable peri-apical situation to pulpotomized than to root-filled roots.

In their study, Asgary and Eghbal do not explain the technical performance of the RCF. However, they establish that pulpotomies are statistically significantly superior to RCTs of vital molars, although radiological failure is neither defined nor numerically expressed. Additionally, the follow-up time of six months is considered very brief.

Summary

A comparison of 710 N2 VAs and 852 N2 root-filled molars after VE was done. The average follow-up period was 53.8 months for VAs and 49.4 for VEs. The total failure rate (radiological and clinical) was 11.9 per cent following VAs, which is equivalent to that of VEs with slight underfilling (RCF level -4, -3). Adequately filled root canals led to fewer failures (8.9 per cent) than VAs. With a failure rate of approximately 19 per cent, the lower first VE- and second VA-molars were most frequently affected.

During the follow-up period, 28.6 per cent of all VA and 14.4 per cent of VE teeth were extracted. Fractured or destroyed teeth were the reason for extraction in 51.9 per cent of all VA and in 46.3 per cent of all VE cases. The extraction reason “endodontic failure” occurred less frequently after VA (23.3 per cent) than VE (36.6 per cent).

For the practice

The patient should be advised of possible pain following the subsiding anaesthetic effect. Analgesics are indicated after VA. An N2 VA is more successful than an insufficient root filling after VE. Vital amputation is indicated in cases of almost inaccessible canal systems, open apical foramina and for economic reasons.

Instead of an extraction or the impossibility of a VE with adequate root filling, it is possible to consider— besides a full pulpotomy—which was the subject of the present study—a partial pulpotomy on:

- upper molars: VA of the buccal canals, filling of the palatinal root
- lower molars: VA of the mesial canals, filling of the distal root
- deep crown margin caries, partial removal of the pulp cavum

Editorial note: A complete list of references is available from the publisher.
Just after Christmas, on 26 December 2010, a 76-year-old male patient, who was in great pain, consulted the emergency dentist. The patient indicated that he felt a throbbing pain in his lower left jaw. The pain was unbearable and had kept him awake all night. The dentist took radiographs of teeth #36 and 37 and an orthopantomogram (OPG; Figs. 1 & 2).

Although the radiograph did not show the full anatomy of tooth #37 and its surrounding structures, the dentist diagnosed apical periodontitis (AP) and advised an endodontic retreatment or extraction and an implant. To make the patient comfortable for the time being, he prescribed 500 mg Amoxicillin and Ibuprofen.

After another sleepless night, the patient consulted a different emergency dentist on 27 December. The analgesics did not give him pain relief and he was starting to become desperate. The second dentist confirmed the original diagnosis and referred the patient to an oral surgeon because an endodontist was not available at short notice. He requested apical surgery on tooth #37.

The following day, the oral surgeon took another OPG and concluded that surgery was not the best treatment option in this case because the apex was located too close to the nervus alveolaris inferior and access to the apices of tooth #37 was difficult.

He also confirmed the diagnosis of an AP and suggested extraction or endodontic retreatment.

On 5 January 2011, the patient visited my office for the first time. The pain had diminished but not disappeared. Intra-oral examination showed a well-restored dentition with a cantilever bridge on teeth #35 to 37, with #36 and 37 functioning as abutments. Tooth #37 showed an occlusal filling in the crown. Palpation of the buccal fold was not painful and there was no mobility of teeth #36 and 37. The pockets of #36 were within normal limits. However, periodontal probing distal of #37 provoked strong pain and extreme bleeding. The distal pocket measured approximately 6mm.

As the previously taken radiographs were not available and the OPT was considered unsuitable for proper diagnosis, a peri-apical radiograph (Fig. 3) was taken. The radiograph showed that tooth #37 had previously been treated endodontically. The mesial canals were filled with silver cones rather too short of the apex. There also appeared to be some gutta-percha and a large metal post in the distal canal. Additionally, radiolucency was noticeable around the apex of the mesial root. According to the patient, he had received endodontic treatment about 15 years ago owing to pain following
bridge cementation. The tooth had been without symptoms since then.

Considering the history and my clinical and radiographic findings, my differential diagnosis was:

1. painful AP owing to reinfection or leakage
2. painful marginal periodontitis distal of tooth #37 owing to poor oral hygiene
3. vertical root fracture (VRF) of the distal root of tooth #37

As diagnosis 1 and 3 would have required rather invasive therapies (retreatment or extraction), we opted to rule out the local marginal periodontitis first. Under local anaesthesia, the distal pocket was thoroughly cleaned and the patient was instructed to use dental floss distal of tooth #37 on a daily basis.

On 31 January, three weeks after initial treatment, the patient returned for evaluation and appeared free of complaints. There was no bleeding on probing and pain could not be provoked.

It should be noted that by selecting this strategy, neither an AP nor a VRF was definitively excluded as a cause of pain. It should be taken into account that owing to the patient being on antibiotics, the symptoms of the AP may have temporarily disappeared and returned at a later stage. Nevertheless, at that point we treated the patient based on history, a radiograph and patient complaints rather than merely on the basis of the radiolucency evident on the radiograph.

In May 2011, the patient returned to our office once again. He was free of complaints, pockets were within normal limits and there was no bleeding on probing.

“The radiographic picture is only one means of diagnosis, the picture may show a lot of rarefaction, but to use it as the sole means of diagnosis is unwise.”

—Thomas Philip Hinman, 1921—
Morita:

New Morita CBCT scanner wins innovation award

Veraviewepocs 3D R100 hailed as ‘amazing development’

The latest Morita cone beam CT scanner won the first Innovations Award at the Clinical Innovations Conference in London. The prize showcases the most pioneering products on the dental market. The Veraviewepocs 3D R100 received the award for its revolutionary Reuleaux triangle full arch field of view. By closely matching the natural dental arch, patient x-ray dosage is reduced by around 15 per cent, compared with a conventional 100mm cylindrical scan.

The award was presented by Mrs Elizabeth Jones, London Dean of Postgraduate Dentistry. An expert panel of eminent dentists and members of journal editorial boards decided that this breakthrough had ‘powerful implications for enhanced patient safety’. Their verdict was that the Veraviewepocs 3D R100 was ‘an amazing development’ which improves accurate detailing when diagnosis and treatment planning are undertaken.

The Morita Veraviewepocs 3D R100 captures posterior dentition that might be missed by a conventional 80mm cylindrical FOV scanner. The unique triangular field of view excludes anatomy outside the jawline which would be exposed to radiation using a standard 100mm diameter cylindrical FOV. The enlarged field of view is especially important when planning implant cases requiring surgical guides and full arch restoration.

With up to three times the image detail of other 3D x-ray systems, the Morita Veraviewepocs 3D R100 and F40 offer the best value in terms of resolution and capital cost. In the UK and Ireland, they are exclusively available from The Dental Imaging Company, an independent specialist in digital radiography solutions.

Built in Japan by J Morita Manufacturing Corporation, Morita cone beam CT scanners provide world-renowned image quality. They give dentists confidence of high definition, distortion-free radiographs. The technology is proving increasingly indispensable in implant dentistry, endodontics and oral surgery diagnosis and treatment planning.

Test drive the Morita Veraviewepocs 3D R100 or F40
For your FREE demonstration call 0845 388 3380 or email: info@morita-uk.com

RECIPROC:

RECIPROC® Files the Endo revolution stops today!

RECIPROC, from Quality Endodontic Distributors Ltd, is not just a new file, but a new concept in canal preparation.

RECIPROC® is the first one file system where no glide path is required (in most cases). It works with a reciprocating action which is driven through the VDW Silver RECIPROC® motor, which can also be used with conventional rotary file systems.

RECIPROC® is made from M-wire™ NiTi which is stronger and more flexible than standard NiTi. There are three files in the range which all have a regressive taper, which means that the apical portion of the file has the greatest taper. The RECIPROC® file sizes are R25 (08/25), R40 (06/40) and R50 (05/50). Each of which is available in lengths 21, 25 and 31mm. The system also has matching gutta-percha and paper points.

RECIPROC® is exclusive to Quality Endodontic Distributors Limited.

For further information telephone Quality Endodontic Distributors Ltd on 01733 404999, email sales@qedendo.co.uk, fax 01733 361243 visit www.qedendo.co.uk or contact your local QED Salesperson.
Smart Plate Technology offers the benefits of digital with the usability of film

Featuring exclusive ‘Scan & Go’ patented technology

Once an x-ray has been taken the exposed plate is passed over a chairside scanner to capture all patient details from the clinical notes (plates are available in the same sizes as film).

This plate is then taken to the CS7600 for scanning. Because it contains all relevant patient information the scanned image is automatically ‘sent’ back to the correct patient’s notes where the dentist is waiting.

The CS 7600 has its own memory, meaning that if the network is lost, the nurse can still scan the image into the unit and it will be stored along with the patients details until the network is live again, at which time it will be delivered back to the correct patient file.

The data on the plates is erased automatically after every use and can be used up to 1000 times.

Waiting time is eliminated and the risks of patients’ x-rays getting mixed up is completely removed. Image quality is also best in class.

For more information or to place an order please call 0800 169 9692
email sales.uk.csd@carestream.com
or visit www.carestreamdental.co.uk
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Optima:
Take control with the Optima MX2 INT from Bien-Air

Bien-Air has developed probably the most efficient dental micromotor on the market with the Optima MX2 INT.

Thanks to Smart Logic technology, the Optima MX2 INT control unit offers ultimate regulation of power required, linearly and without vibration ensuring you are perfectly in control of the speed, torque and reversal at all times. With Easy-Nav philosophy the Optima MX2 INT is incredibly intuitive and adapts to most dental chairs. Being particularly versatile the control unit offers 10 pre-programmed modes for your main restorative work and 10 sequences for your endodontic work, all at the quick press of a button.

This Swiss made control unit has been developed with your endodontic work in mind. You can perform your root treatments with complete peace of mind, as the Optima MX2 INT has been designed to reduce the risk of NiTi instrument breakage to an absolute minimum with the precise auto reverse function.

A true all-in-one system the Optima MX2 INT makes your life easier! In most cases two contra-angle handpieces are sufficient to carry out the vast majority of dentistry, so go on take control with the Optima MX2 INT from Bien-Air.

Optima MX 2 INT drives the new LED MX 2 Micromotor. MX 2 is shorter and lighter than its predecessor and with its shortened nose accepts Bien-Air’s new Micro-Series contra-angles, as well as standard contra-angles. The combination of both the MX 2 and Micro-series is a reduction in the overall length of 30 per cent and a weight reduction of 23 per cent!

For further information contact Bien-Air on 01293 550 200 or visit www.bienair.com.

Sirona
New software update supports the hands-free operation of the SIROEndo endodontic treatment system

As soon as the file reaches the apex of the root canal the dentist can reverse the direction of rotation via the foot switch.

Version 5.2 of Sirona Dental Systems’ SIROEndo software is the passport to more effective and convenient root canal treatment. As soon as the dentist reaches the apex he can reverse the rotation of the file – either on the SIROEndo unit or via the foot control. Just one brief touch is enough to change from clockwise to counter clockwise rotation and vice versa.

Introduced six months ago, the new apex indicator keeps the user informed at all times. The exponential progress bar now consists of 18 blocks as opposed to six. It indicates the distance between the file tip and the apex. When the file tip reaches the apex an “A” is displayed. The message “-1” is shown as soon as the tip extends beyond the apex. This is accompanied by differentiated acoustic signals. A series of short beeps can be heard as the file approaches the apex. This changes to a continuous tone when the file tip goes beyond the apex.

“Since the launch of SIROEndo at IDS 2005 we have continuously developed the software,” said Anja Weidemann, Product Manager in the Instruments Division of Sirona Dental Systems.

For further information please contact: Sirona Dental Systems 0845 071 5040 Info@sironadental.co.uk.
Adding LISTERINE® Total Care to your patients’ daily prevention routine finishes the job started by mechanical cleaning

Communicating the value of a three-step daily prevention process – brush, floss and rinse – to patients in an effective manner will help to keep the message resonating between appointments, improving their commitment to better oral health.

Following mechanical cleaning with a mouthwash that will lower the bacterial burden in the mouth is an extremely important part of achieving the ultimate in oral care at home, and something that patients need to understand is their responsibility. You can help patients do this by promoting a partnership approach that clearly and concisely presents the benefits of combining daily prevention with regular hygiene appointments.

Brushing and flossing/interdental cleaning are pivotal to oral hygiene. They displace and dislodge plaque bacteria that can cause gingivitis and periodontal disease from the tooth surface. But bacteria from other areas of the mouth can recolonize on teeth quickly.¹

Using LISTERINE® after mechanical cleaning destroys bacteria effectively, killing up to 97% of them in vivo.²

This lowers the bacterial burden in the mouth and in plaque that reforms.³ And when used for six months, LISTERINE® can reduce plaque levels by up to 52% more than brushing and flossing alone.⁴

The LISTERINE® Total Care range

The LISTERINE® Total Care range ensures that there is an effective adjunct to help reduce plaque bacteria and manage biofilm in every patient. Plaque biofilm is the main cause of gum disease, and plaque formation begins immediately after brushing. LISTERINE® has broad antibacterial effects against a wide range of species of germs, killing them by destroying their cell walls and inhibiting their ability to multiply.

In addition to containing the LISTERINE® four essential oils – menthol, thymol, methyl salicylate and eucalyptol – which have antibacterial properties and kill plaque bacteria, LISTERINE® Total Care products offer various levels of fluoride and other benefits to suit patients’ needs.

Finish the job. Finish off with Listerine.
Diary Dates

UK EVENTS

Resolving clinical challenges in restorative dentistry: Endodontics and aesthetics on tooth and implant supported prostheses
14 September 2012
The Midland Hotel, Manchester

British Dental Trade Association (BDTA)
4-6 October 2012
Excel, London

2012 Regional Meeting
16-17 November 2012
The Bristol Marriott Royal Hotel, Bristol

Study day 2012: Endodontics 2012
7 December 2012
FGDP(UK) Scotland and the Royal College of Physicians and Surgeons of Glasgow

INTERNATIONAL ENDODONTICS EVENTS 2012

Trans Tasmanian Endodontic Society
21-23 June 2012
3rd Trans-Tasman Endodontic Conference
Gold Coast Convention & Exhibition Centre
Australia

Annual Meeting (ENDO)
ENDO 2012
23-26 June 2012
Houston, Texas

Scandinavian Endodontic Society
23-25 August 2012
Skand Endo, Oslo, Norway

FDI World Dental Congress
29 August –01 September, 2012
Hong Kong

World Dental Show
5-7 October, 2012
Mumbai

EAO Congress
11-13 October, 2012
Copenhagen

DENTEX
18-20 October, 2012
Brussels

Expo Dental
18-20 October, 2012
Milan

Swedental
15-17 November, 2012
Göteborg

GNYDM
23-28 November, 2012
New York
Lisbon, Portugal
submissions: formatting requirements

Please note that all the textual elements of your submission:

- all the complete article
- all the figure captions
- all the contact info (bio, mailing address, E-mail address, etc.)

must be combined into one Word document. Please do not submit multiple files for each of these items.

In addition, images (tables, charts, photographs, etc.) must not be embedded into the Word document. All images must be submitted separately, and details about how to do this appear below.

Text length

Article lengths can vary greatly—from a mere 1,500 to 5,500 words—depending on the subject matter. Our approach is that if you need more or less words to do the topic justice then please make the article as long or as short as necessary.

We can run an extra long article in multiple parts, but this is usually discussing a subject matter where each part can stand alone because it contains so much information. In addition, we do run multi-part series on various topics.

In short, we do not want to limit you in terms of article length, so please use the word count above as a general guideline and if you have specific questions, please do not hesitate to contact us.

Text formatting

Please use single spacing and un-indented paragraphs for your text. Just place an extra blank line between paragraphs.

We also ask that you forego any special formatting beyond the use of italics and boldface, and make sure that all text is left justified.

If you would like to emphasise certain words within the text, please only use italics (do not use underlining or a larger font size). Boldface is reserved for article headers.

Please do not "centre" text on the page, add special tab stops, or use underlining as all of this must be removed before layout. If you require a special layout, please let the word processing program you are using help you to do this formatting rather than doing it by hand on your own.

If you need to make a list, or add footnotes or endnotes, please let the Word processing program do it for you automatically. There are menus in every program that will help you to do this. The fact is that no matter how careful one might be, errors have a way of creeping in when you try to hand number footnotes and literature lists.

Image requirements

Please number images consecutively throughout the article by using a new number for each image. If it is imperative that certain images are grouped together, then use lowercase letters to designate the images in a group (ie 2a, 2b, 2c).

Please put figure references in your article wherever they are appropriate, whether that is in the middle or end of a sentence. If you are not directly mentioning the figure in the body of your article, when it appears at the end of the sentence the figure reference should be enclosed within parenthesis and be inside the sentence, meaning before the fullstop.

In addition, please note:

- We require images in TIF or JPEG format.
- These images must be no smaller than 6 x 6 cm in size at 300 DPI.
- Images cannot be any smaller than 80 KB in size (or they will print the size of a postage stamp!).

Larger images are always better, and something on the order of 1 MB is best. Thus, if you have an image in a large size, do not bother sizing it down to meet our requirements but send us the largest file sizes available. (The larger the starting image is in terms of bytes, the more leeway the designer has in terms of resizing the image to fill up more space should there be room available).

Also, please remember that you should not embed the images into the body of the text document you submit. Images must be submitted separately from the textual submission.

You may submit images through a zipped file via E-mail, unzipped individual files via E-mail, or post a CD containing your images directly to us (please contact us for the mailing address as this will depend upon where in the world you will be mailing them from).

Please do not forget to send us a head shot photo of yourself that also fits the parameters above so that it can be printed along with your article.

Abstracts

An abstract of your article is not required. However, if you choose to provide us with one, we will print it in a separate box.

Contact info

At the end of every article is a Contact Info box with contact information along with a head shot of the author. Please note at the end of your article the exact information you would like to appear in this box and format it according to the previously mentioned standards. A short bio may precede the contact info if you provide us with the necessary information (60 words or less).

Questions?

Please contact us for our Author Kit, or if you have other questions:

Group Editor
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Lisa Townshend Group Editor
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Online Patient Appointment Booking allows patients to book appointments online, whenever they want to, or need to, even out of normal surgery hours.

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Two Nuromol tablets provide:
• Stronger pain relief
• and is effective for longer
than TWO tablets of an Ibuprofen + codeine combination*

The outcomes of a dental pain study comparing the efficacy and tolerability of a novel single tablet combination of Ibuprofen and Paracetamol with that of an Ibuprofen/codeine combination and a paracetamol/codeine combination using the dental impaction pain model. This comparison relates to cumulative pain relief over 12 hours following a single dose.

* The maximum allowed OTC dose in the UK is 1000mg paracetamol plus 25.6mg codeine.

NUROMOL does not contain actives known to cause addiction

Nuromol 200mg/500mg Tablets (film-coated) Essential information Refer to the SmPC for full details.

Active ingredients: Each tablet contains Ibuprofen (200mg) and Paracetamol (500mg). Indications: For the temporary relief of mild to moderate pain associated with: migraine, headache, backache, period pain, dental pain, rheumatism and muscular pain, pain of non-serious arthritis, cold and flu symptoms, sore throat and fever. This product is especially suitable for pain which requires stronger analgesia than Ibuprofen or Paracetamol alone. Dosage instructions: Adults over 18 yrs: One tablet to be taken up to three times per day with water; if needed, dose may be increased to two tablets three times a day. Leave at least six hours between doses. Maximum of 6 tablets per 24 hours. To minimise side effects it is recommended that patients take Nuromol with food. If symptoms persist, worsen or if the product is required for more than 3 days, the patient should consult a doctor. Elderly: The lowest effective dose should be used for the lowest possible duration. The patient should be monitored regularly for gastrointestinal bleeding when using a NSAID. Contra-indications: Known hypersensitivity to Ibuprofen, Paracetamol or any other excipients. History of hypersensitivity reactions associated with acetylsalicylic acid/NSAIDs. History of, or an existing gastrointestinal ulceration/perforation or bleeding, defects in coagulation, severe hepatic failure, severe renal failure or severe heart failure. Do not give: in conjunction with use with other paracetamol-containing products, in concurrent use with other NSAID-containing products, including cyclo-oxygenase-2 (COX-2) specific inhibitors and doses of acetylsalicylic acid above 75 mg daily, during the last trimester of pregnancy. Side effects, precautions: The risk of paracetamol overdose is greater in patients with non-steroidal anti-inflammatory drug (NSAID) allergy. Immediate medical advice should be sought in the event of an overdose, even if the patient feels well, because of the risk of delayed, serious liver damage. Caution is required in elderly patients and in patients with certain conditions: respiratory disorders, cardiovascular, cerebrovascular, renal and hepatic impairment, gastrointestinal bleeding, ulceration and perforation, SLE and mixed connective tissue disease. Severe skin conditions and impaired female fertility may occur. Warnings for use: do not give to patients who have taken Ibuprofen or Paracetamol in the last 6 hours; do not give in combination with paracetamol or NSAID containing medicine. Common side effects: abdominal pain, diarrhoea, dyspepsia, nausea, stomach discomfort and vomiting, increase in amino-transferase, gammaglutamyltransferase, blood creatine, blood urea, liver dysfunction. Recommended retail price: (ex. VAT): £8.95, £12.50, £23.33 and £24.50. £5.95. Supply classification: P. Marketing authorization holder: Reckitt Benckiser Healthcare (UK) Ltd, Slough, SL1 3UN. Tel 0800 455 456. MA number: PL 00033/0579. Date last revised: September 2010.

Adverse events should be reported. Reporting forms and information can be found at www.mhra.gov.uk/yellowcard. Adverse events should also be reported to Reckitt Benckiser Healthcare (UK) Ltd on: 0800 455 456. NUROMOL and the target device are trademarks.

Further information: For replacement kits or enquiries concerning this product, please contact our Medical Information Unit via email info.miu@reckittbenckiser.com

References
1. RB Data on file: Study No. NL0811.2010. Two Nuromol tablets compared with two tablets of Ibuprofen 200mg and Codeine 12.8mg.