Aussie scientists develop new coating to improve implants

By DTI

MELBOURNE, Australia: Prebiotic compounds, whose origin can be traced back billions of years, have been studied intensively since their discovery several years ago. Now, a team of researchers in Australia has found that these prehistoric molecules can be used to modify surfaces of medical implants, reducing the risk of infection and rejection.

The new coating method was developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in collaboration with microbiologists at Monash University.

Although surface modification methods span a wide variety of applications, ranging from solar cells to implantable medical devices, there are very few simple generic aqueous coating methods that are both robust and versatile, as well as easily applicable over a range of substrate materials, the researchers reported in their paper. Therefore, they examined the suitability of the amimonomalonitrile polymerisation process for the formation of coatings on a range of substrate materials.

Dr Richard Evans has helped develop a coating for medical devices using prebiotic molecules.

Victims of Pompeii had excellent teeth

By DTI

NAPLES, Italy: To this day, researchers have not been able to scan and analyze the world-famous plaster casts of the people and animals of Pompeii who died in the volcanic eruptions of Mount Vesuvius in AD 79. Now, with the help of a 16-layer scanner, an interdisciplinary team was able to create digital 3-D reconstructions of the skeletons and dental arches of the volcano’s victims for the first time.

Among other things, the scientific tests, which included the use of a special multi-layer CT scanner, laser imaging and DNA sampling, revealed that the city’s inhabitants had nearly perfect teeth.

“We discovered the absence of cavities in the teeth. This is very interesting and not that surprising, because we all know about the healthy Mediterranean diet and this has really shown up in the early analyses,” said Massimo Osanna, superintendent at the archaeological site.

According to the experts, the lack of sugar in the Pompeian diet and the high levels of fluoride in the air and water near the volcano are all accountable for the perfect state of their teeth.

In addition to an excellent oral health, the researchers found that most of the victims still had all their teeth.

However, the scans further showed that the teeth wore away, because they were used for cutting, orthodontist Dr Elisa Vanacore said.

The interdisciplinary research project that began in April brought together archaeologists, restorers, radiologists, anthropologists and many others. According to Osanna, many more findings will emerge from the analyses on most of the known 86 Pompeian casts. “It will reveal much about the victims’ age, sex, what they ate, what diseases they had and what class of society they belonged to,” the scientist said.

This will be a great step forward in our knowledge of antiquity.”

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ENDO TRIBUNE
Read the latest news and clinical developments from the field of endodontics in our specialty section included in this issue.

NZ heli crash

By DTI

WELLINGTON, New Zealand: Last month, the wreck of a helicopter was found in a crevasse on Fox Glacier, a glacier on the west coast of New Zealand’s South Island. Although it is still unclear what caused the crash, the New Zealand Police have confirmed that the pilot and the six passengers died. On board the aircraft were a retired dentist and his 70-year-old wife used to work in a dental surgery in Totton in the UK.

The 28-year-old pilot, two young women from New South Wales, and another couple in their fifties from Cambridge in the UK also died in the crash.
In September this year, DENTSPLY International and Sirona Dental Systems announced that they have entered into a definitive merger agreement, creating probably the world’s largest dental manufacturer, DENTSPLY SIRONA. Dental Tribune spoke with Sirona President and CEO, Jeffrey T. Slovin, who will assume the role of CEO of the newly combined company, about the merger and its impact on the global dental market.

As you know, the global dental industry is in the midst of a transformation. The market is moving toward more integrated solutions and practitioners across the globe. Furthermore, many practitioners in new emerging markets are rapidly adopting digital dentistry. Combining DENTSPLY and Sirona will create the world’s leading manufacturer of professional dental products and technologies, strengthening our collective ability to be at the forefront of key industry trends, help dental professionals improve patient care and grow our business.

DENTSPLY and Sirona both have strong commitments to innovation and research and development. In fact, we have collaborated very successfully on product development with DENTSPLY in the past. This merger is about harnessing those shared strengths to create new products with the aim of advancing patient care. Additionally, Sirona’s technology and equipment offerings are complementary with DENTSPLY’s consumables platform, enabling us to offer more robust product platform to dental professionals and distributors.

Together, we will drive better, faster and safer dentistry around the world.

The new company will be the world’s leading manufacturer of professional dental products and technologies. How will this affect the global dental industry?

After the merger, DENTSPLY SIRONA will be a stronger and larger global company with a broader product platform, deeper focus on innovation and the largest sales and services infrastructure in the dental industry. When you consider how much the global dental industry has recently changed, it should be expected that dentistry would continue its rapid evolution. Today, general practitioners are taking on more specialized procedures that require integrated workflows with consumables and equipment that enhance their efficiency and patient care offering. You’re also seeing an increasing demand for dental care from developing and emerging markets. We expect these needs to continue evolving and that DENTSPLY SIRONA will provide solutions to address their continuous needs.

With our combined focus on innovation and research and development, DENTSPLY SIRONA is very well positioned to meet both the current demands of the global dentistry industry, as well as anticipate and address future demands. Coupled with the largest sales and services infrastructure in the dental industry and supported by leading dental distributors and a direct sales force, we will be able to serve the dental industry more effectively worldwide. The merger is truly a win for everyone involved.

The merger is expected to be completed in the first quarter of 2016. It should be expected that digital dentistry and practices could still present a definitive merger.

The transaction is currently on track with the aim to complete the process in the first quarter of 2016. There are, as with any transactions, certain regulatory approvals and other customary closing conditions that we must achieve first. These include anti-trust clearance in the US, Europe and other countries, all of which are outlined in our SEC filings. We are confident that we will receive these approvals and the approval of our shareholders and we look forward to closing the transaction. Until then however, both DENTSPLY and Sirona will continue to run their business as usual as separate entities.

Are you looking into opportunities to acquire other dental companies? Right now we are focused on continuing to run the business and execute our Sirona strategy successfully. We are also working toward closing the merger with DENTSPLY. Our future is full of opportunity and we are working hard to deliver on that promise to our employees, patients and the entire dental community.

Thank you very much for this interview.
Deviations between implant positions found

By DTI

HANGZHOU, China: In measuring the effect of surgical templates on the accuracy of implant placement, a Chinese study recently found that actual and planned implant positions varied significantly. According to the researchers, errors in computer-guided implant surgery are caused by either the operator during surgery or the surgical template preoperatively.

In order to evaluate the effect of surgical templates on the accuracy of implant placement, jaws from 16 patients were scanned using cone beam computed tomography (CBCT). Fifty-three implants were planned in a virtual 3-D environment, of which 35 were placed in the mandible and 18 in the maxilla.

For the analyses, a stereolithographic surgical template was created. The template was then fitted on a plaster model and both were scanned with a CBCT device. The images obtained were matched to images of the virtual planned implant position. The actual implant position was acquired from the registration position of the surgical template.

In comparing the data, the researchers found significant deviation between actual and planned positions caused by the surgical template. The mean central deviation at the hex and apex was 0.456 mm and 0.515 mm, respectively. The mean horizontal deviation at the hex was 0.193 mm and at the apex was 0.277 mm. The mean vertical deviation at the hex was 0.388 mm and at the apex was 0.390 mm. The mean angular deviation was 0.621°.

The results of the study indicate that clinicians should not rely solely on the safety of surgical templates in seeking to avoid critical anatomical structures.

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Study confirms CBT to be successful in reducing dental phobia

By DTI

LONDON, UK: The latest government figures estimate that one in ten people in the UK suffer from dental anxiety. New research from King’s College London involving pre-treatment use of cognitive behavioural therapy (CBT) has shown that the method is largely effective in helping patients overcome their fear of treatment.

In a study involving patients suffering from high levels of dental phobia, the researchers found that the overall majority were able to undergo treatment without sedation after having undergone therapy at the Dental Institute Health Psychology Service at Guy’s and St Thomas’ NHS Foundation Trust. Only six per cent of the patients surveyed had to be treated with sedation.

“Our study shows that after on average five CBT sessions, most people can go on to be treated by the dentist without the need to be sedated,” said Tim Newton, lead author and Professor of Psychology as Applied to Dentistry.

A short-term therapy, CBT has been shown to help with depression and a number of anxiety-related disorders, such as obsessive-compulsive disorder and bulimia. Typically, over six to ten sessions, a therapist aims to help patients change their feelings and behaviours by restructuring their thinking and breaking negative thought cycles.

According to the researchers, the most common anxiety-inducing factors in the study were identified as drilling and having an injection.

Newton recommended that, despite the positive outcome, CBT should be viewed as complementing sedation services rather than as an alternative, the two together providing a comprehensive care pathway for the ultimate benefit of patients. Furthermore, patients should be carefully assessed by trained CBT practitioners, since they could be suffering from additional psychological conditions.

Over one-third of those patients surveyed in the study showed signs of general anxiety, while one in ten had depression or suicidal thoughts.

“CBT provides a way of reducing the need for sedation in people with a phobia, but there will still be those who need sedation because they require urgent dental treatment or they are having particularly invasive treatments,” Newton said.

With CBT a therapist aims to help patients change their feelings and behaviours by restructuring their thinking and breaking negative thought cycles.
Just as social media has become a part of everyday life, so too has it entered the health sector. With patients blogging about dental visits and practitioners promoting their business on Facebook, a number of legal and ethical issues arise. Dental Tribune had the opportunity to speak with book author and health counsellor Sara Natt och Dag about the possibilities and risks entailed in the use of social media in health care.

Could you describe how social media has found its way into the health sector over the last several years?

Sara Natt och Dag: In Europe, social media began to influence healthcare maybe seven or eight years ago, whereas in the US it started maybe ten years ago, and its importance is growing exponentially. It has become normal for health care and social media to be interlinked. In Sweden, for example, the e-health sector already plays an important role. From scheduling a doctor’s appointment to ordering medication, one can do virtually everything online.

However, the dental industry appears to have been a bit slower than the rest of the sector. The importance of social media in dentistry has exploded in the last year especially. Although there is probably no such thing as private dental blogs, dental topics are creeping into the lifestyle industry with people writing about orthodontic and aesthetic treatments to a large extent.

So, there is a great deal of information—both professional and personal—available on the Internet? In the Western world, most people have access to the Internet at home and virtually everywhere. Thus, they have access to unlimited information from all over the world. However, regarding health topics a lack of boundaries may be a matter of concern. Take cancer blogs, for example. In Sweden, there are many of these types of personal blogs. Where patients share everything about their diagnosis, treatment plan, medication, set-backs, feelings—everything—I have followed some of these patients until their death on their blogs. They share their personal disease progression with the whole world and that is a bit crazy, I think.

A blog can offer support and comfort to terminally ill people, but this frankness certainly poses new challenges for health care professionals. I meet many sick people who run blogs and always advise them not to write when they are upset or disappointed. Instead, I tell them to talk to the doctor or the nurses about their feelings instead of posting it online.

In other areas, as I mentioned earlier, health topics are starting to overlap with lifestyle topics. One can find review videos for whitening strips on YouTube, people talking about their latest dental appointment on Facebook and so on. For many young people, it is natural to share their personal experiences. Medical professionals can take advantage of this as a way to better understand and familiarise themselves with what patients are doing and thinking.

Would you agree that this trend has great potential, both positive and negative?

Yes, absolutely. If a lifestyle blogger writes about his or her dental appointment, with the name of the dentist tagged, and does that several times, the dentist will rank higher in search engines. Even one person can make a difference—is that not crazy?

A Swedish lifestyle blogger just recently wrote about her dental treatment and how fantastic her dentist is. She has about 200,000 followers, so you can imagine what happened. The dentist, in turn, published a link to her posts on the clinic website, because he was proud of being mentioned by an online “celebrity.” This demonstrates the interconnectedness of social media channels—which can be very good and also very bad for one’s reputation, depending on what was written online.

Focusing on the advantages: how can dentists use social media most effectively to promote their business?
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“Dental topics are creeping into the lifestyle industry with people writing about orthodontic and aesthetic treatments to a large extent.”

If practitioners do have permission from the patient, they cannot share case details online, not in health care. At least, it is illegal in Sweden. What should be taken into account then? What is your advice for practitioners?

It is as simple as thinking before publishing online. Dentists who remain aware of their professional status at all times can use social media as a very powerful tool.

But if dentists are not allowed to discuss cases and patients in particular, what could they write about online?

They should promote themselves instead. Introduce themselves (including their education), their practice and the staff.

It is all about standing out from the crowd and showing some personality. They could write about their travels to conferences, for example, send out Merry Christmas wishes, introduce new tools that they have bought for the practice, basically, it is about staying in touch with patients. One does not have to post daily, but if one writes regularly, maybe once a week, it can be an excellent way to promote one’s business.

Still one has to draw a definite line between one’s professional and private lives. One’s business page is not the place to discuss one’s children, one’s last holiday, or feelings or personal opinions regarding one’s patients.

In social media, just like with any professional doctor–patient relationship, it is all about defining boundaries and maintaining them.

How should health care professionals best respond when patients cross these boundaries and write harmful comments online?

I am sure some people choose to ignore these instead of confronting the writer. Personally, I would rather address the matter directly. However, I know many colleagues who rather not respond. From a legal point, it can be difficult to erase negative comments from Facebook or the Internet in general, so maybe it is best to settle the issue privately.

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What do our teeth betray about us? — Part II

By Dr Stanislav Cícha, Czech Republic

In the first part of this article series, I described the significance of individual teeth in terms of emotional and health status, considering specifically the canines. In the second part, I will focus on the premolars and molars. The first premolars represent our desires and our own self, simply described with the words “I want” (Fig. 1).

The maxillary right first premolar reflects how we would like to appear on the outside and the left one represents our emotional desires.

The maxillary first premolars are among the most frequently treated teeth, with interventions ranging from fillings to endodontic treatment, crowns and extractions (Fig. 2). This does not come as a surprise, since every day we are confronted with notions perpetuated by the media regarding how we should look and what we should buy to reach this ideal. Instead of fulfilling our true emotional desires, we are urged to follow the crowd.

The mandibular right first premolar reflects the ability to realise our goals and the left premolar shows our ability to convey our feelings and wishes in our environment.

With the first premolars, there arises the question of orthodontic extractions. The author of the book *Quand les dents se mettent à parler* (When the teeth talk), Dr Michèle Caffin, mentions that extractions of first premolars weaken the sense of self, and children with extracted premolars tend to submit easily to authority figures despite not wanting to do so. I cannot confirm nor refute this, as I have only had a few patients who have undergone this treatment and was not able to observe them over a longer period.

The second premolars can be characterised by the sentence “I want to create” or the term “our creative ego” (Fig. 3). The maxillary right second premolar represents our development in the outside world, our children and our hobbies, and the left second premolar our natural abilities.

The mandibular right second premolar, similar to the adjacent first premolar, reflects the ability to realise our goals, particularly in our professions. After the reconstruction of anodontia using an inlay bridge, an indocentive young female patient successfully finished school to the great joy of her parents (Fig. 4).

In contrast, Figures 5 & 6 are photographs.
The mandibular left second premolar indicates the assimilation of the maternal energy in our lives. Linguistic inclination, the persistence of primary tooth #15 and its reinsertion point to the situation in which a child does not want to or cannot mature into an adult. Behind this is often the dominant influence of the mother, similar to the case of retraction of tooth #22, which we learnt about in the first part of this article series.

Fortunately, mothers generally do not know about these effects. Thus, after successful orthodontic treatment initiated by them and the subsequent realignment of the permanent second premolar, they are very surprised by the transformation of their once-obedient child with a self-conscious personality.

The first molars (Fig. 7) are closely associated with the status that we desire both in society and in our families: Fulfilling ideals to improve our position in society is linked to the maxillary and mandibular right first molars, and they reflect our professional lives and our successes in this regard. The patient shown in Figure 8 had to leave her beloved profession owing to family circumstances. She broke this tooth after a failed relationship. A radiographic examination revealed that all of the other teeth remained intact.

The second molars reflect our relationships with the world around us and in particular with the closest relatives (Fig. 9). Both right second molars reveal, through their status and alignment, ordinary circumstances of daily life. Long-term recurring situations, often considered trivial in our contexts, that annoy us but that we are not able to change may manifest in these teeth.

The left second molars can show how harmonious the relationships with our family members are. I had a juvenile patient who was struggling to cope with an ongoing love triangle in his family. Endodontic treatment was indicated for his maxillary left second molar, yet the entire dentition showed hardly any tooth decay (Fig. 10). His brother, who did not have to deal with such a situation, did not have any dental problems. In this context, I would like to emphasise that teeth reflect life circumstances according to the subjective perception of the person concerned.

As dentists, third molars are usually of marginal interest to us, except for surgeons and endodontists, who can show off with perfectly filled root canals of bizarre shapes in these teeth. From a holistic perspective, however, third molars express the individual energy of a person (Fig. 11). The maxillary right third molar corresponds to our efforts to contact the material and spiritual worlds. The maxillary left third molar represents the fear of rejection by both these worlds. The mandibular right third molar is a barometer of our physical energy.

In order to learn more about this topic, I recommend that you read the latest edition of "Quand les dents se mettent à parler" and I wish you many interesting discoveries in observing the manifestations of the professional and emotional lives of your patients in their teeth.

Editorial note: This is the second of a two-part article which first appeared in "Cosmetic Dentistry" 2/15. A complete list of references is available from the publisher.
Efficiently delivering full-mouth reconstructions

By Dr Ara Nazarian, USA

Having the ability to take a patient from point A to point Z in fewer appointments within one’s practice allows one to position oneself as a provider that can fulfill patient’s surgical and restorative needs. With the proper training, a dental provider may provide extraction, grafting and implant placement within one appointment at one location. Not only does this allow the reduction of the number of visits for the patient, but this type of service also helps the patient stay within his or her budget. Most importantly, this enables the dental provider full control of the surgical and prosthetic outcome.

Depending on the patient’s desires, the clinical conditions of the oral environment and the skills of the dentist, the dentist may choose to extract teeth, level bone, and graft with simultaneous dental implant placement. In this case, a patient in his mid-sixties presented to the office with discomfort owing to multiple rampant caries and generalised advanced periodontal disease and graft with simultaneously, the patient decided to come to us for full treatment after being referred by his general practitioner. Having already visited multiple providers for a consultation, he was very frustrated with the treatment options offered with varying treatment plans that were segmented into different disciplines. Since many of these options did not complement the other, the patient decided to come to us for full treatment after being referred by a provider full control of the surgical and prosthetic outcome.

An increasing number of patients are presenting to dental practices who seem to require this type of reconstruction.

The final treatment plan was fixed bridges on implants in the maxillary and mandibular arches. Engage implants were selected (Fig. 5) because I have personally experienced their high implant stability at placement, which is a critical success factor during the early healing process of osseointegration with these types of cases. With the combination of its patent-pending Bull Nose Auger tip and Mini Cortic-O Thread, this implant system offers practitioners a bone-level implant with high initial stability for selective loading options. In fact, the Engage implant body creates a tapping pattern when threaded for an enhanced mechanical lock in the bone. Other dental implant systems with aggressive threading may include, but are not limited to, Nobel Active (Nobel Biocare), SEVEN (MIS Implants Technologies), ET III (Hiossen), I5 (AB Dental) and AnyRidge (Megagen).

For effectiveness and greater proficiency during the Total Dental Solutions Reconstruction procedures, intravenous sedation should be performed. Not only does it make the appointment easier, but patients also prefer to have the treatment completed in one visit. Since the patient is sedated, a mouth prop is needed to keep his or her mouth open. Because of this, teeth are extracted in quadrants, starting from the upper left to the upper right and then down to the lower right and lower left. This allows great time savings, as it is easier to keep the patient’s mouth open and be able to proceed around the arches safely. Once the teeth have been extracted, the tissue has to be reflected in order to seat the bone-level surgical guides and fix them with their respective retention pins. Using these pilot surgical guides, the osteotomies for the implants were begun with a 1.95 mm pilot drill utilising the Mont Blanc surgical handpiece (Anthogyr) and Aseptico surgical motor (ASU 1000) at a speed of 1,200 rpm with copious amounts of sterile saline (Figs. 6 & 7).

Paralleling pins were placed in the sites of the osteotomies to confirm the accuracy of the surgical guide and radiographs were taken to check the angulations of the pins within the maxilla and the mandible. Once the osteotomies were complete, an...
Implant finger driver was used to place the dental implants until increased torque was necessary. The ratchet wrench was then connected to the adapter and the implants torqued to final depths, reaching a torque level of approximately 40–50 Ncm.

Adequate implant fixation was further verified using an Osstell ISQ (implant stability quotient) meter, which uses resonance frequency analysis as a method of measurement (Fig. 8). Several studies have been conducted on resonance frequency analysis measurements and the ISQ scale. They provide valid indications that the acceptable stability range lies above 55 ISQ.

Extended healing caps were hand tightened to the implants. A postoperative radiograph was taken of the implants and the healing caps to ensure complete seating. The immediate dentures were soft relined with a silicone-based soft denture relining material (UFI GelSC, VOCO). Some of the advantages I have personally experienced with this material are that it is biocompatible, tasteless and odourless. By using the extended healing caps with the soft reline, the immediate dentures were much more retentive. The soft tissue and implants were evaluated clinically after one week. The patient stated that he had had very little postoperative discomfort or swelling.

Within ten days, the patient returned to the practice. The soft tissue around the extended healing caps had healed very nicely with a healthy pink colour. Using impression posts, full-arch impressions were taken with Instant custom CB-CB Trays (Good Fit). These custom trays can be adapted and fitted in minutes, eliminating the need for models, light-cured materials, monomers and extra laboratory time for custom impression tray fabrication because they are made of a material (PMMA) that becomes mouldable when heated (Fig. 9) and maintains its shape while cooling.

Once the trays had been moulded for the patient, full-arch impressions were taken using a polyvinyl siloxane impression material (Take I Advanced, Kerr; Fig. 10). Bite relations, as well as instructions for size, shape and colour of the full-arch provisional restorations, were forwarded to the dental laboratory. With only a five-day turnaround, the custom abutments and provisionals were forwarded to the dental office and inserted. The patient was very pleased with the aesthetics and function of these provisional restorations. He was instructed about their care and use in eating, speaking and biting.

Approximately four months after the initial placement of the dental implants, the patient returned for the definitive porcelain-fused-to-metal restorative impressions. The provisional restorations were removed using the Easy Pneumatic Crown and Bridge Remover (Dent Corp). Any temporary cement was removed and the abutments inspected. If there was any settling or recession of the gingival tissue, the abutments were modified using a carbide bur with copious amounts of water not to overheat the abutments. This way, the margins could be brought right to or to slightly below the free gingival margin. A full-arch impression was taken in a similar fashion for the abutments and the provisionals. In addition, the relations between maxillary and mandibular arches were captured. Within three weeks, the porcelain-fused-to-metal restorations were inserted and a panoramic radiograph taken (Figs. 11 & 12).

In conclusion, an increasing number of patients are presenting to dental practices who seem to require this type of reconstruction. By providing multiple services in a shorter number of visits with the use of CBCT and other technologies, the dental provider will find that more patients will accept treatment. In doing so, not only are you helping your patients regain proper form and function, but you are also helping them achieve a Total Dental Solutions Reconstruction in fewer appointments.
An innovative adhesive luting protocol

All-ceramic anterior crowns (IPS e.max Press lithium disilicate) placed with Monobond Etch & Prime

By Prof. Claus-Peter Ernst, Germany

Anterior crowns come in many different variations, from purely functional to highly aesthetic, depending on the requirements and means of the patient, the skill of the dental technician, availability of materials, and preparation and cementation procedures used. Many anterior crowns considered to be aesthetic in the past no longer meet the demands of today’s patients. The example detailed in this article is a case in point.

When she presented to our practice, the 20-year-old high school graduate wished to have the crowns on her two central incisors replaced (Fig. 1). At the age of 14, she had sustained anterior tooth trauma that apparently damaged the mesio-incisal part of the incisal edges of both teeth. The dentist she had consulted at that time restored her teeth with porcelain-fused-to-metal (PFM) crowns. Even though the extent of the trauma can no longer be assessed, today’s alternatives—in light of the patient’s young age in particular—would most probably have been a direct composite restoration.

Figure 2 shows the two central incisors in detail from the labial aspect and Figure 3 shows an incisal view. The crowns did not exhibit any functional defects. As a result, the main treatment aim was to improve the aesthetic appearance of the anterior teeth as requested. Subsequently, the patient was informed about the treatment procedure, in particular about any possible additional preparation requiring the removal of tooth structure, as well as the cost involved.

The treatment was begun at a separate appointment. The restorations were fabricated by the dental laboratory of Hildegard Hofmann (Mainz, Germany). Pressed all-ceramic IPS e.max lithium disilicate (Ivoclar Vivadent) crowns were selected for this case, since they are the first choice for this type of indication. This has been confirmed by numerous clinical studies, including the recently published German Sy Clinical Practice Guideline on ceramic restorations.

The teeth were anaesthetised at the placement appointment. The crowns were removed and the bonding surfaces were carefully cleaned with ultrasound and a fluoride-free cleaning paste. Since the new Variolink Esthetic DC (Ivoclar Vivadent) had been chosen as the luting material, the crowns were tried in with the corresponding try-in pastes. An immediate match to the adjacent and the mandibular anterior teeth was achieved with the Neutral shade. No adjustments were necessary with regard to a lighter (light) or darker (Warm) shade of the luting composite. We attributed this excellent match to the dental technician having selected the shade at the chairside. The extra expense of this step far outweighs the inconvenience of having to make numerous adjustments or new restorations because of a shade mismatch.

Conditioning of the crown

Saliva and residue of the try-in paste were removed (Ivoclean, Ivoclar Vivadent) from the crowns before they were conditioned. It is advisable to fabricate a “handle” to allow the inner crown surfaces to be conditioned without having to touch the crown with the fingers. In this case, the crowns were attached to a brush holder with a light-curing provisional composite. This handle also allowed the crowns to be placed with ease during the luting procedure. As an alternative, an OptraStick (Ivoclar Vivadent) could have been used. Hydrofluoric acid etching and silanising, therefore, combines the steps of hydrofluoric acid etching and silanisation and it even appears to render cleaning with Ivoclean superficial. The currently available in vitro data justifies using this new product with due care to replace the hydrofluoric acid etching and silanising method. Even though it has not been shown to improve the bonding values in relation to the established references, no negative effects on the adhesive bond have been found to date either. Moreover, since the adhesive bond to glass ceramics is considered to be the most unpredictable interface in the bonding process of indirect restorations, no clinical irregularities are to be expected.

In the case presented, the crowns could even have been placed by conventional or self-adhesive means. The loss of retention would have been as unlikely as the occurrence of a ceramic fracture due to inadequate adhesive support. Figure 6 shows one of the two crowns after Monobond Etch & Prime had been rinsed off and the surface dried with blow-air.

Cementation of the crowns

Variolink Esthetic DC was used for the adhesive cementation of the...
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No pain, All Gain
The bonding surfaces were cleaned with a fluoride-free prophylaxis paste. Next, Adhese Universal adhesive (Ivoclar Vivadent) was applied from the pen applicator (Fig. 9). The remaining thin enamel margin was not etched, in order to prevent any gingival bleeding. Adhese Universal was scrubbed into the conditioned tooth surface for >20 seconds as stated in the directions for use. According to the manufacturer, this time should not be reduced, as it is not sufficient to simply paint the adhesive on to the tooth surface. Next, the adhesive was dried with blown air until an immobile, glossy film was left. The adhesive was then light cured for 10 seconds (Fig. 10).

Since the universally compatible adhesive forms a considerably thinner film than does Heliobond (Ivoclar Vivadent), for example, it can be light cured without encountering any subsequent problems of fit or bite elevation. The polymerised adhesive layer on teeth #11 and #21 is visible in Figure 11. Figures 12 and 13 show the adhesive-bonded IPS e.max lithium disilicate crowns at the final follow-up appointment, four weeks after the treatment. The gingiva was free from any irritation and the crowns blended smoothly with the surrounding teeth. The tremendous improvement in the appearance of the anterior teeth achieved with the all-ceramic restorations on teeth #11 and #21 is visible in the close-up photograph shown in Figure 14. For the first time in many years, the patient dared to smile again (Fig. 15).

Conclusion

It takes quite a bit of courage to use innovative products and procedures, such as those described in this article. Adequate clinical data is not yet available, let alone the much-needed long-term studies. Nonetheless, a start must be made somewhere. For those dental practitioners who would like to be rid of hydrofluoric acid sooner rather than later, the described self-conditioning glass-ceramic primer may offer a viable option.

Since the etching time has a significant influence on the strength of the ceramic when hydrofluoric acid is used to condition ceramic restorations, the specifications of the manufacturer must be strictly observed. IPS e.max Press lithium disilicate should be etched for 20 seconds if 5% hydrofluoric acid is used. Other conventional glass-ceramics require 60 seconds of etching. DeguDent (DENTSPLY) recommends that its material CELTRA be etched for 30 seconds. The reaction time of Monobond Etch & Prime is 60 seconds on all types of ceramics. Thus, it offers a first step in the direction of error prevention. It remains to be seen whether external studies can confirm the effectiveness of the product in establishing an adhesive bond on ceramics other than those from Ivoclar Vivadent.

Pola Night: and 9.5% hydrogen peroxide
Pola Day: 16% and 22% carbamide peroxide
Pola Day CP: Available in 35% carbamide peroxide
Irrigation dynamics in root canal therapy

By Prof. Anil Kishen, Canada

Irrigation dynamics deals with the pattern of irrigant flow, penetration, exchange and the forces produced within the root canal space. Current modes of endodontic irrigation include the traditional syringe needle irrigation or physical methods, such as apical negative-pressure irrigation or sonic/ultrasonically assisted irrigation. Since the nature of irrigation influences the flow of irrigant up to the working length (WL) and interaction of irrigant with the canal wall, it is mandatory to understand the irrigation dynamics associated with various irrigation techniques.

Endodontic irrigants are liquid antimicrobials used to disinfect microbial biofilms within the root canal. The process of delivery of endodontic irrigants within the root canal is called irrigation. The overall objectives of root canal irrigation are to inactivate bacterial biofilms, inactivate endotoxins, and dissolve tissue remnants and the smear layer (chemical effects) in the root canals, as well as to allow the flow of irrigant entirely through the root canal system, in order to detach the biofilm structures and loosen and flush out the debris from the root canals (physical effects). While the chemical effectiveness will be influenced by the concentration of the antimicrobial and the duration of action, the physical effectiveness will depend upon the ability of irrigation to generate optimum streaming forces within the entire root canal system.

The final efficiency of endodontic disinfection will depend upon both chemical and physical effectiveness. It is important to realise that even the most powerful irrigant will be of no use if it cannot penetrate the apical portion of the root canal, interact with the root canal wall and exchange frequently within the root canal system.

Syringe irrigation

Irrigation methods are categorized as positive-pressure or negative-pressure, according to the mode of delivery employed. In positive-pressure techniques, the pressure difference necessary for irrigant flow is created between a pressurized container (e.g. a syringe) and the root canal. In negative-pressure techniques, the irrigant is delivered passively near the canal orifice and a suction tip (negative-pressure place deep inside the root canal creates a pressure difference. The irrigant then flows from the orifice towards the apex, where it is evacuated. A detailed understanding of the irrigation dynamics associated with syringe-based irrigation would aid in improving its effectiveness in clinical practice.

Irrigation flow during syringe irrigation

The flow of irrigants is influenced by its physical characteristics, such as density and viscosity. These properties for the commonly used endodontic irrigants are very similar to those of distilled water. The surface tension of endodontic irrigants and its decrease by surfactants have also been studied extensively. The rationale of this combination is that it may significantly affect (a) the irrigation penetration into dentinal tubules and accessory root canals and (b) the dissolution of pulp tissue. However, it is important to note that surface tension would only influence the interface between two immiscible fluids, and not between the irrigant and dentinal fluid.

Experiments have confirmed that surfactants do not enhance the ability of sodium hypochlorite to dissolve pulp tissue or the ability of chelating agents to remove the smear layer. The type of needle used has a significant effect on the flow pattern formed within the root canal, while parameters such as depth of needle insertion and size or taper of the prepared root canal have only a limited influence. Generally, the available needles can be classified as closed-ended and open-ended needles. In the case of open-ended needles (flat, bevelled, notched), the irrigant stream is very intense and extends apically along the root canal. Depending upon the root canal geometry and the depth of needle insertion, reverse flow of irrigant occurs near the canal wall towards the canal orifice.

In the case of closed-ended needles (side-vented), the stream of irrigant is formed near the apical side of the outlet and is directed apically. The irrigant tends to follow a curved route around the needle tip, towards the coronal orifice. The flow of irrigant apical to the needle is generally observed to be a passive fluid flow zone (dead zone), while the flow of irrigant in the remaining aspect of the root canal is observed to be an active fluid flow zone (active zone).

Large needles when used within the root canal hardly penetrate beyond the coronal half of the root canal. Currently, smaller-diameter needles (28-ga, 30-ga) have been recommended for root canal irrigation. This is mainly because of their ability to advance further up to the WL. This facilitates better irrigant exchange and debridement. In addition, the use of a larger needle would result in decreased space available for the reverse flow of irrigant between the needle and the canal wall. This scenario has been associated with (a) an increased apical pressure for open-ended needles and (b) decreased irrigant refreshment apical to the tip for closed-ended needles. The influence of tooth location (mandibular, maxillary) on irrigant flow has been observed to be minor.

Irrigant refreshment

Irrigant exchange in the root canal system is a key prerequisite for achieving optimum chemical effect, because the chemical efficacy of the irrigants are known to be rapidly inactivated by dentine, tissue remnants and the smear layer. Investigations have explained the limitations in the irrigant refreshment apical to needles in E. coli by enlarging the root canal to place the needle to a few millimetres from the WL and ensuring adequate space apical to the needle for reverse flow of the irrigant towards the canal orifice. Following refreshment and egression of the irrigant from the needle tip, the fresh irrigant can be delivered to the entire root canal space for optimum chemical and physical effects.

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Figs. 1a–d: Velocity magnitude of irrigation showing the extent of dead zone. With the open-ended needle tip (a), the velocity progressively decreased 1.5 mm apical from the tip. With the side-ventured needle tip (b), there was a much lower velocity than with the open-ended tip, and it extended only 0.5 mm. With the apical negative-pressure irrigation (c), there was a constant velocity slightly higher than the side-vented needle irrigant that was constant as the irrigant moved coronally. The ultrasonically assisted irrigation (d) showed the highest magnitude of velocity, constant to at least 3 mm coronal to the tip placement.

Figs. 2a–d: Time-averaged distribution of shear stress on the root canal wall showing a more uniform distribution on the canal wall with the open-ended needle tip (a). The side-vented needle tip (b) showed a localised region with a high amount of shear stress, while there was not an observable level with the EndoTRIB (c). The ultrasonically assisted irrigation (d) displayed the highest levels of shear stress over the greatest area of the canal wall.
The effect of curvature on irrigation has been studied indirectly by Nguy and Sedgley. They report that only severe curvatures in the order of 24–28° hampered the flow of irrigants. If the canal is enlarged to at least size 30 or 35 and a 30-gauge flexible needle placed near the WL is used, then irrigant refreshment can be expected even in severely curved canals.

Wall shear stress

The frictional stress that occurs between the flowing irrigant and the canal wall is termed “wall shear stress”. This force is of relevance in root canal irrigation because it tends to detach microbial biofilm from the root canal wall. Currently, there is no quantitative data on the minimum shear stress required for the removal of microbial biofilm from the canal wall. Yet, the nature of wall shear stresses produced within the root canals during irrigation provides an indication of the mechanical debridement efficacy. In open-ended needles, an area of increased shear wall stresses develops apical to the needle tips, while in closed-ended needles, a higher maximum shear stress is generated near their tips, on the wall facing the needle outlet. Thus, in open- and closed-ended needles, optimum debridement is expected near the tip of the needles. Consequently, it is necessary to move the needle inside the root canal, so that the limited area of high wall shear stress involves as much of the root canal wall as possible. The maximum shear stress decreases with an increase in canal size or taper. Thus, overzealous root canal enlargement above a certain size or taper could diminish the debridement efficacy of irrigation (Figs. 12–d & 22–d).

Enhancing irrigation dynamics using physical irrigation methods

Fluid dynamics studies on apical negative pressure irrigation have demonstrated maximum apical penetration of the irrigant, without any irrigant extrusion. This finding highlights the ability of apical negative-pressure irrigation to be safely used at the WL, circumventing the issues of apical lock effect. Nonetheless, the apical negative pressure irrigation produced the lowest wall shear stress. This decrease in the wall shear stress could be attributed in part to the reduction in the flow rate with this irrigation system.

The requirements of adequate irrigation penetration, irrigant exchange, mechanical effect and minimum risk of apical extrusion on opposite each other and a subtle equilibrium is required during irrigation. Ideally, in a canal enlarged to size 30 or 35 and taper 0.04 or 0.06, an open-ended needle should be placed 2 or 3 mm short of the WL to ensure adequate irrigant exchange and high wall shear stress, while reducing the risk of extrusion.

In the case of a closed-ended needle, placement should be within 1 mm short of the WL, so that optimum irrigant exchange can be ensured. The apical negative-pressure irrigation did not generate marked wall shear stress values, but allowed the flow of irrigant consistently up to the WL. It was the safest mode of irrigation when used close to the WL. The passive ultrasonically assisted irrigation generated the highest wall shear stress. The use of combined methods to obtain optimum disinfection and to circumvent the limitations of one method is recommended.

Conclusion

The requirements of adequate irrigation penetration, irrigant exchange, mechanical effect and minimum risk of apical extrusion on opposite each other and a subtle equilibrium is required during irrigation. Ideally, in a canal enlarged to size 30 or 35 and taper 0.04 or 0.06, an open-ended needle should be placed 2 or 3 mm short of the WL to ensure adequate irrigant exchange and high wall shear stress, while reducing the risk of extrusion.
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Use of mineral trioxide aggregate in endodontic retro-filling

By Fernanda Maria Klimpel, Brazil

Mineral trioxide aggregate (MTA) is an endodontic sealer that emerged on the market in 1998. Through proven scientific results, it has become the true miracle of endodontics. An excellent sealing material, it provides setting expansion and integrity of the seal owing to low solubility, tissue biocompatibility, and high biological regeneration. The release of calcium ions provides antibacterial activity. Its radiopacity is excellent, and it can be used for thermal condensation owing to its melting point of 150 °C.

MTA also has good capacity for adhesion to dentine, making it resistant to the forces of displacement, and greater sealing power than other cements when tested to assess the quantity of bacterial infiltration. It is indicated for treatment of perforations in the furcation region, of internal resorption, and of root perforations via surgery when it is impossible to treat the perforation via the canal or treatment has been unsuccessful, for use in para-endodontic surgery as a retro-filling material, and for direct pulp protection, pulpotomy, apexitis, and apicification.

**Literature review**

MTA is a biocompatible material with numerous clinical applications in endodontics. It was first used experimentally by Lee and Monsel. However, approval of its use in humans by the American Dental Federation was not granted until 1998.

It is composed primarily of tricalcium silicate, tricalcium aluminate, tricalcium oxide and silicate oxide, as well as a small quantity of other mineral oxides and the addition of bismuth oxide, which is responsible for the material’s radiopacity. The principal molecules present in MTA are calcium and phosphorus ions, which are also the main components of dental tissue, giving MTA excellent biocompatibility when in contact with cells and tissue.

MTA has been investigated as an alternative material in endodontics and can be used in retro-filling of root canals. Although the retro-filling material is very important, good sealing of the suitable apex is made for this purpose. According to Assis et al., many techniques and instruments have been recommended for carrying out apical preparation.

Both brands of MTA have been significantly evaluated and no other material has shown more progressive results. According to Poza et al., the use of MTA in cavity walls, unlike other materials, achieves the best seal against infiltration. Different materials have been used to seal the paths connecting the root canal and the para-endodontic tissue. However, none of them have achieved results as promising as those of MTA and various studies have proven that MTA is the best on the market today. According to Leal, MTA cement has effective sealing capacity.

According to Bernabe et al., conventional endodontic treatment is not able to resolve some cases and para-endodontic surgery is required to obtain a good result. The filling material used must not be toxic or mutagenic and has to be biocompatible and insoluble. The material used in retro-filling distinguishes a good para-endodontic surgery from a bad one. MTA achieves the best results specifically for sealing between the tooth and external surface.

Endodontic treatment has become more practical owing to the new methods and techniques, with the emergence of materials with excellent physical and biological properties. The literature deals with various materials used in retro-filling, but generally speaking, these materials do not have all the requisite properties to be able to remain in the cavity, such as biocompatibility, radiopacity, insolubility in periapical fluids, easy compounding, non-staining of the periadicular tissue, good adaptation and sealing capacity. An ideal material to replace amalgam should offer adhesion, promote hermetic sealing, be biocompatible, be radiopaque, be easy to compound and provide for an environment favourable for tissue regeneration.

According to Hellwig et al., para-endodontic surgeries expose and remove dental apices, promote retro-cavitations along the axis of the root canal, and retro-fill them with materials that promote their sealing. Para-endodontic surgery is an excellent option for conservative treatment of teeth with chronic periapical lesions, and treatment by the conventional method is impractical in some cases.

According to Jacobovitz et al., treatment of inflammatory resorption must be directed at combating endodontic infection. In certain cases, clinical resolution using conventional endodontic treatment can become unfeasible owing to the difficulties of performing instrumentation and adequate full...
Para-endodontic surgeries have various procedural methods that aim to resolve failures or accidents that occur in conventional endodontic treatment. According to Girardi et al., apicectomy is a method of para-endodontic surgery that entails the separation of the apical portion from the root. It is performed when there is no regression of the apical lesion after the alternatives of conventional endodontic therapy have been exhausted in an attempt to eliminate the apical micro-organisms and their toxic products.

The use of a high-quality retro-filling material is indispensable, if an anterior injury is intended. An increase in apical infiltration may occur, since the dentinal tubules are more exposed by certain cutting angles and permeability is hence increased, and this is important at the time of applying the filling material.

According to Oliveira et al., in an apicectomy with retro-filling using MTA and monitoring after five years, it was observed that teeth with a persistent periapical fistula, after having undergone a suitable endodontic treatment, the surgical retreatment with retro-filling may be an efficient option in the resolution of the lesion and repair of the periradicular tissue.

The literature confirms that MTA presents excellent physical, chemical, and biological properties, which justify it as the material of choice in the treatment of radicular resorption. It is a material that, compared with other restorative materials, has less microleakage and is capable of inducing the formation of mineralised tissue, such as bone, dentine and cementum, owing to it reaching a pH plateau of around 12.5 in 3 hours. According to Costa et al., who analysed the clinical application of MTA in relation to the apical region, in cases in which radicular resorption is minimal, the canal is filled with calcium hydroxide to stimulate the repair, closing the access cavity with zinc oxide and eugenol.

Among the various advantages of MTA is minimal radiopacity, which has proven to be an important criterion and contributes to it being considered the best choice by the dental surgeon in relation to biomaterials to be used in para-endodontic surgery.

According to Barros and Araújo Filho, MTA has been used successfully in filling the apical space of the root canal. In addition to its excellent sealing capacity, it is biocompatible with the peri-radicular tissue, and induces the formation of cementoblasts and osteoblasts.

Clinical case

This case illustrates the use of MTA for sealing the root perforation and the effectiveness of the retro-filling material after apicectomy (additional surgery). A 31-year-old patient presented to the Universidade Taubaté Parana dental clinic (Brazil) complaining about a gap in the gingiva above tooth 11, from which a large quantity of purulent discharge was draining. In the radiographic examination, an extensive radiolucent area was found, indicating a fistula (periapical lesion) involving the periradicular region of the tooth in question.

During the endodontic treatment, the secretion into the tooth could not be controlled. Even 23 days after treatment, with changes to the intra-canal medication, the fistula returned and the exudate via the canal persisted. After treatment, with changes to the intra-canal medication, the fistula returned and the exudate via the canal persisted. Definitive sealing of the root perforation was then opted for, utilizing MTA and continuing with changes to the calcium hydroxide in the root canal. Owing to the persistence of the exudate via the canal, it was decided to perform endodontic filling, followed by supplementary surgical treatment (apicectomy) with retro-filling with MTA, conserving the tooth structure as much as possible.

The surgery was performed under local anaesthetic with an infraorbital nerve block and supplementary infiltrative anaesthesia at the apex of the tooth, as well as a nasopalatine nerve block. The anaesthesia used was 3% mepivacaine with 1:1,000,000 adrenaline.

The incision was made with a #15 scalpel blade and a flap was raised. The ostectomy was performed with a high-speed drill of the 700 series in order to gain access to the periradicular region. The lesion was curetted with a short curette. An apicectomy was performed with the drill and 2 mm of the apex was removed. The cavity for retro-filling was prepared with a spherical drill under constant irrigation with saline solution, and then the retro-filling with MTA was performed. After condensation of the material in the cavity, the excess was removed with a periodontal curette. Finally, the flap was repositioned and then sutured.

One 750 mg pill of acetaminophen every 6 hours for two days was prescribed. In the seven-day postoperative control period, the patient had no symptoms incompatible with the surgery performed and the healing appeared normal.

These circumstances held for the full monitoring period, over the course of a year, as the radiograph one year after treatment established new bone formation in the region, proving the success of the case. At the end of the surgical treatment, the patient was referred for prosthetic treatment.

Conclusion

According to the methodology used in this case and considering its results, it can be concluded that the MTA material used was efficient in the formation of a new mineralised tissue barrier, completely sealing the apical portion of the canal.

Fernanda Maria Klimpel is working as a dentist in Brazil.
The One Shape Procedure Pack
A unique solution for root canal shaping

Dr Tara McMahon, Belgium

The objective of endodontic treatment is the elimination of pulp debris or the bacterial biofilm and its toxins from the root canal system in order to prevent or eliminate any periapical lesion. For this purpose, root canal shaping is an essential, necessary and complex step. Essential because it allows indispensible irrigation, necessary to achieve 3-D obturation of the endodontic root canal system and complex because of the infinite complexity of the root canal anatomy.

Over the past several years, the definition of an endodontically successful root canal treatment has changed considerably. In 1986, success was based on the complete disappearance of the periapical lesion. For this purpose, root canal shaping is an essential, necessary and complex step. Essential because it allows indispensible irrigation, necessary to achieve 3-D obturation of the endodontic root canal system and complex because of the infinite complexity of the root canal anatomy.

The introduction of single-use instruments not only eliminates the risk of cross-contamination, but also considerably reduces the risk of instrument fracture due to cyclic fatigue and simplifies the operating procedure. MICRO-MEGA has designed the One Shape Procedure Pack, which contains an ENDODFLARE file, a #10 MMC file, a One G file and a One Shape file (Fig. 1). It simplifies the operating procedure, removes the need for instrument maintenance and makes stock management easier. All of the necessary instruments for the endodontic treatment are single-use files supplied in sterile packaging.

Operating procedure
Each endodontic treatment requires a preoperative radiograph taken with a radiograph film holder (Fig. 2). Once a dental dam has been placed and the access cavity has been prepared, the root canal entrances are localised and the pulp chamber is irrigated with sodium hypochlorite (Fig. 3). The first step of the root canal preparation is the enlargement of the canal entrances. As the first instrument in the One Shape Procedure Pack, ENDODFLARE (with a diameter of 0.23 and a 0.02 taper) is used with up-and-down movements and pressure on the canal walls in the first 3–4 mm of the root canal to enlarge the canal orifices. In this case, ENDODFLARE eliminates the dentinal overhang at the entrance to the distal root canal (Fig. 4) and lays open the second mesiobuccal canal (Fig. 5).

Fig. 1: Photograph of One Shape in the second mesiobuccal canal (P: palatal canal; DB: distobuccal canal; MB: mesiobuccal canal).—Fig. 2: Pre-op radiograph of tooth #17.—Fig. 3: Opening of the pulp chamber (P: palatal canal; DB: distobuccal canal; MB: mesiobuccal canal).—Fig. 4: Elimination of overhang with ENDODFLARE (P: palatal canal; DB: distobuccal canal; MB: mesiobuccal canal).—Fig. 5: After the passage of ENDODFLARE, access to the distobuccal canal is straightened (P: palatal canal; DB: distobuccal canal; MB: first mesiobuccal canal; MB2: second mesiobuccal canal).—Fig. 6: Exploration file, #10 MMC, in the distobuccal canal.—Fig. 7: One G.—Fig. 8: Radiograph of One G in the second mesiobuccal canal.
The exploration file (#10 MMC) serves to evaluate the root canal’s complexity. It is introduced into the root canal without axial constraints in the coronal zone, owing to the previous action of ENDO-FLARE. Any coronal interference that might hinder the file’s passage must be eliminated to make the treatment as safe as possible (Fig. 6).

The second step of the root canal preparation is the exploration of the root canal and the creation of a glide path. This step entails the pre-enlargement of the root canal and facilitates the passage of the following rotary shaping instrument. Root canal exploration and glide path development are performed with stainless-steel hand files or rotary NiTi files. It has been shown that the use of a highly flexible instrument with an asymmetrical cross-section reduces the risk of canal transportation. In addition, this kind of cross-section combined with a variable helical pitch diminishes screwing effects.

The second rotary instrument in the One Shape Procedure Pack is One G (Fig. 7). This NiTi instrument with a diameter of 0.14 and a 0.09 taper has an asymmetrical cross-section. Its three cutting edges are situated on three different radiiuses to the root canal axis. One G also has a variable helical pitch and thus variable helical angles. The narrower the angle, the more active the rotating instrument, and the wider the angle, the greater the efficiency of the instrument’s traction. All of these features provide One G with a high flexibility and great efficiency.

Clinically, if the root canal is patent, One G is taken to the working length (WL) previously determined with the #10 MMC file and an apex locator. However, if the root canal is not patent, One G penetrates with vertical up-and-down movements on the canal axis down to the length attained by the #10 MMC file. This allows the elimination of constraints in the cervical and middle thirds of the root canal. The #10 file is then pre-curved in order to check the canal patency. The WL is determined and transferred to One G, which is then taken to the WL at a speed of 250–450 rpm and a maximum torque of 1.2 Ncm (Figs. 8 & 9). After the creation of the glide path with One G, the #15 MMC file must penetrate down to the WL without constraints. The root canal is now ready for shaping.

The third rotary instrument is One Shape (Fig. 10). This NiTi instrument with a diameter of 0.23 and a 0.06 taper has a variable cross-section. The apical 2 mm of its active blade with a global length of 16 mm has a triple-helix cross-section with three cutting edges situated on three different radiiuses to the canal axis. The following 7.5 mm constitutes a transitional zone that terminates in a double-helix section of 6.5 mm in the coronal part of the file.

The cutting effect of the two cutting angles in the coronal zone is more important and allows more efficient elimination of the debris, whereas the three cutting angles in the apical zone provide the instrument with a better centring ability, a higher resistance to torsional constraints and a better capacity to negotiate curves. The instrument’s tip is inactive and allows for a smooth progression in the root canal. The helical pitch and angle are variable along the instrument and thus guarantee better upward transport of the debirs and limit screwing effects. Owing to its characteristics, One Shape causes less extrusion of debris and irrigating solution in the apical zone than other single-file systems available on the market.

One Shape performs the root canal preparation quicker than other single-file system. This gain in time must be used for the indispensable final irrigation.

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