Direct pulp capping as a conservative procedure to maintain pulp vitality

By Dr. Jenner Argueta, Guatemala

From a completely optimistic point of view, the ultimate goal for every dentist performing a restorative and/or endodontic procedure should be to maintain the pulpal vitality and functionality of the tooth without any discomfort for the patient. The pulp tissue is needed to provide nutrition, innervation, and immunocompetence, with these acting as a defence mechanism and alerting to the presence of any external aggression.

The pulp tissue may be exposed to the oral environment as a result of dental caries or by mechanical means when performing restorative or prosthodontic procedures. Two possible treatment options in these types of cases are root canal therapy and tooth extraction; the former procedure is a good choice, whereas the latter should be avoided at all costs in order to maintain the patient’s oral health and natural function.

A third alternative in the case of pulp exposure is to use conservative vital pulp therapy procedures, which include direct pulp capping, indirect pulp capping where the pulp is not fully exposed, and partial or total pulpotomies; this way, it is possible to maintain the vitality of the tooth, the nociceptive function and the body’s self-defence system. Thanks to the points mentioned previously, among others, it has been shown that teeth with no root canal therapy survive longer than those that have been treated endodontically.

Next, we present two clinical cases in which the pulp tissue was exposed mechanically when carious tissue was removed. In both cases, it was managed to maintain the pulp vitality of the affected teeth by means of direct pulp capping. The vital pulp capping protocol suggested in this article is presented in the first case. The second case describes a treatment performed with long-term follow-up, where full formation of calcified tissue below the capping material could be observed by means of radiography.

Clinical Case 1

The 24-year-old patient attended the dental clinic with transient provoked pain in tooth #19 (Fig. 1). The diagnosis was reversible pulpitis. The carious tissue was removed under complete isolation, producing two incidences of pulp exposure, with minimal bleeding (Fig. 2). Bleeding was stopped by applying pressure for 10 seconds using a cotton swab dampened with a sterile saline solution. The cavity was disinfected with 2.5% sodium hypochlorite (Fig. 3), and then white mineral trioxide aggregate (MTA, Produits Dentaires) was placed as a direct pulp capping material (Fig. 4). To ensure that the MTA was placed accurately, the MAP System micro-applicator for dental materials (Produits Dentaires) was adapted to the cavity. The treatment protocol was similar in both cases.

Clinical Case 2

The 44-year-old patient attended the dental clinic with transient provoked pain in tooth #19 (Fig. 5). The diagnosis was reversible pulpitis. The carious tissue was removed under complete isolation, producing two incidences of pulp exposure, with minimal bleeding (Fig. 2). Bleeding was stopped by applying pressure for 10 seconds using a cotton swab dampened with a sterile saline solution. The cavity was disinfected with 2.5% sodium hypochlorite (Fig. 3), and then white mineral trioxide aggregate (MTA, Produits Dentaires) was placed as a direct pulp capping material (Fig. 4). To ensure that the MTA was placed accurately, the MAP System micro-applicator for dental materials (Produits Dentaires) was adapted to the cavity.
was used. This system allows the clinician to place the material exactly on the exposure site, and this avoids staining the dentinal walls, which could over time show pigmentation due to the material used (Figs. 5 & 6).

Once the MTA was placed on the sites of pulp exposure and the deep parts of the pulp chamber roof, a light-curing calcium hydroxide paste was applied. This was used to protect the material (Fig. 7) and to be able to proceed to the bonding procedure, to put the final restoration of the tooth in place during the same session (Figs. 8 & 9).

Seven days after the procedure, the patient was completely asymptomatic and the tooth responded normally to sensitivity tests. In clinical situations like this, it is expected that there will be radiographic evidence of mineralised tissue formation below the cap between six and nine months after the procedure.

Clinical Case 2

The 35-year-old patient attended the dental clinic with transient provoked pain in tooth #4. The diagnosis was reversible pulpitis. The same vital pulp therapy protocol described in the first case (Figs. 10–12) was followed, except that in this case, the permanent restoration was not put in place during the same session. In its place, a temporary non-radiopaque restorative material was placed. This made it possible to ascertain the suitable thickness of the pulp capping material and its precise positioning at perforation level, while keeping the dental margin clear for a good bonding protocol (Figs. 13–15). It has been reported that the success rate of vital pulp therapy procedures may drop when the final restoration is put in place two days after the initial procedure. The MAP System is very useful for precise and stable placement of the capping material in direct procedures, indirect procedures, and partial and total pulpal.
potomies. Here, the final restoration was placed 15 days after the initial procedure and the patient was completely asymptomatic. Nine months later, full formation of calcified tissue could be seen at the level of the pulp capping, the tooth remained vital and the patient was completely asymptomatic (Fig. 16).

Obtaining the right diagnosis is key to the success of conservative pulp therapy. An ideal case is a diagnosis of reversible pulpitis with no previous history of spontaneous or prolonged dental pain. It is generally accepted that a history of spontaneous pain or pain at night is associated with the existence of an irreversible pulp inflammation process. In these cases, the success of direct pulp capping may be questionable.12 Although there are studies indicating that vital pulp therapy can be successful even in these situations,13, 14 When it comes to the long-term success of conservative pulp procedures, it is extremely important to provide a final permanent restoration for the tooth that ensures a suitably marginal seal. The reason is that this last factor, in conjunction with the absence of bacterial contamination during the procedure, is among the most important factors to consider in order to avoid subsequent pulp inflammation.6 The success rate reported for vital pulp therapy procedures using MTA with a follow-up period of up to ten years is greater than 80%,15 — a fairly high percentage for a dental procedure within that functional period.

Tattoo note: A list of references is available from the publisher. This article was published in the 3/2018 issue of Roots, International Magazine of Endodontics.

A contemporary endodontic approach using bioceramic cement

By Prof. Dr. Leandro A. P. Pereira

Endodontics is the specialty of dentistry which prevents or treats pathologies of pulp and periradicular origin. The ultimate goal is to cure the endodontic disease and allow the affected tooth to reestablish its aesthetic/functional functions through a complementary restorative treatment.

Obturation of the root canal system is an important step in endodontic treatment and its function is to fill and seal the canals to prevent their recontamination. With the evolution in intracanal microbiological knowledge and the impact of new canal modeling instruments with continuous or alternating rotation, we know that it is not possible to completely eliminate the microorganisms inside the endodontic microanatomy. However, we also know that this is not necessary for success, and that the significant reduction in the levels of intracanal infection, in most cases, is sufficient to achieve success (Siqueira). Thus, at the time of obturation, it is necessary to create an intracanal environment which is unfavorable to the population growth of the remaining bacteria. Therefore, another function of obturation is to prevent or hinder the growth of residual bacteria not eliminated during the cleaning and disinfection process.

To achieve the desired objectives, obturation cements must have essential properties in order to be used clinically. These are: capacity to fill, seal, and present dimensional stability; not being soluble in the organic tissue fluids; having a film thickness or no more than 50 micrometers; being radiopaque; having good strength; not producing chromatic alterations; having suitable working time; to set and be easy to manipulate; to be able to remove if necessary; to promote cementogenesis; to be biocompatible and non-irritating to the tissues of the peritapex (Kenneth M. Hargreaves 2000).

However, with the development of new materials and rehabilitation concepts in the era of adhesive dentistry, the search for two other characteristics has become increasingly important in the development of new endodontic cements. One of them is the absence of exudate, which interferes in the strength of the bond of the resin systems (Vano et al 2006). The other characteristic is bioactivity. Bioactivity is the capacity of a material to be integrated with the tissues and structures of the organism with which it is in contact. Bioactivity of the MTA is known as a biomaterial and was first described by Reyes and Carmona in 2009. In one in vitro study, the authors used scanning electron microscopy images to observe the interaction of the MTA with the dentin through deposition of numerous apatite groups on the dental collagen fibrils throughout the dentinal tubule surface in contact with the MTA. Another very interesting factor is that the authors observed that the more contact time the material had with the dentin, the more extensive the mineralizations were. These mineralizations took place, integrating the material with the dentin, and may be responsible for the superior adaptation of this material to the dentin (Torabinejad 1995; Reyes-Carmona 2009).

However, the low drainage capacity of MTA does not allow for its use as an obturating cement. Thus, to get the benefits of this material’s biocompatibility, a new class of obturating endodontic cement was created, known as silicate-based cements. This designation is derived from the components which make up the MTA and which are present in these cements. They are: Tricalcium silicate, Dicalcium silicate, Calcium Oxide and Tricalcium aluminate.

The clinical case below shows the

MTA-Fillapex

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After the modeling of the canals, the system of canals was dried and filled with EDOTA 17% and an ultrasonic tip (Helse) was used to passively activate the substance for 7 cycles of 15 seconds with renewal of the substance for each cycle. After the ultrasonic passive activation, the canals were again irrigated with 5% of Sodium Hypochlorite at 2.5%. The main gutta percha cones were tested and adjusted. After this, the system of canals was dried with aspiration micro-cannulas connected to a vacuum sucur.

The Fillapex MTA cement (Angelus) was prepared and introduced into the canals using the main gutta percha cones. The excess from the cones was cut using a heat transfer system (Touch’n Heat Sybron Endo) and cold compressed vertically. The pulp chamber was sealed with photopolymerizable composite resin and the patient was sent to her dentist for definitive restoration of the dental element to be performed. After 17 months, the patient came in for a control consultation, and on the X-ray, it was possible to observe endodontic success characterized by the absence of signs and symptoms, the tooth functioning physiologically, normality of the peripex, and reabsorption of the surplus Fillapex MTA.

short-duration positive response shown to cold, with a negative response to heat.

According to the classification of the American Endodontics Association, tooth 36 had a pulpal and periapical diagnosis of irreversible inflammatory pulpitis with normal periapex. The treatment indicated was endodontic treatment.

The treatment was conducted in its entirety with the use of an Operative Microscope, varying the magnification between 2.5 and 12.5X. Access to the pulp chamber was done with a 1013 spherical diamond bit followed by a 3082 conical-truck diamond bit and the finishing was done with a conical-truck diamond ultrasonic tip (T1 D Helse). According to the classification of the American Endodontics Association, tooth 36 had a pulpal and periapical diagnosis of irreversible inflammatory pulpitis with normal periapex. The treatment indicated was endodontic treatment.

The next step was to conduct electronic odontology with a foramen locator and to establish the real work length. On the work length, the diameter of the region was verified through introduction of different calibers of manual type-K files until one of them is observed to adapt to the lateral walls of the canals. In the mesial canals, the instrument which adapted to this region was the #30, and in the distal canal, #40. In this way, and in the same initial operative sequence or preparation, modeling, and irrigation, the mesial canals were prepared for the Reciproc 40 (VDW) instrument, and the distal was prepared for the Reciproc 50 (VDW) instrument.
Top performance Flexible NiTi file
HyFlex EDM performs well internationally

By Coltene

In the course of two major international events in the dental industry, Swiss dental specialist COLTENE interviewed over 150 dentists and Endo experts about their experiences with its latest NiTi file system. The results of the product tests are more than impressive: 98% of the participants would continue to use the HyFlex EDM for the treatment of their endodontic cases, even after the tough test.

The necessary cutting edge
Every two years, both the International Dental Show in Cologne (IDS for short) and the Congress of the European Society for Endodontics (ESE Congress) serve as an international platform for professionals with an interest in endodontics to exchange experiences between colleagues. Thus, both events in 2017 provided the ideal occasion for a large-scale test campaign for the latest NiTi file generation from COLTENE. Selected dentists and joint practices throughout Europe were given the opportunity to put the flexible HyFlex EDM file system through its paces. 76% of the participants particularly praised the high flexibility that leads to good adaptation in the canal. The pre-bendable files work reliably in all the lengths and sizes currently available on the market without displacing the centre of the canal. Like the proven HyFlex™ CM files, the HyFlex™ EDM files also possess the so-called “Controlled Memory” effect and are distinguished by their preservation of the natural root canal anatomy. These smart features were also evaluated positively in the test and the dentists use the robust high-performance instruments primarily for cases where they want to produce reliable results quickly with a reduced number of files.

Additional files sizes allowing more flexible application
Due to limited access endo experts often want more flexibility from their instruments. Pre-bendable tools can extend the horizon into new dimensions. Particularly in a limited working space, modular nickel-titanium systems display their full strength. With a total of seven highly flexible file variants, COLTENE offers a wide-ranging HyFlex NiTi program. In addition to the usual lengths of 25 mm, all preparation files of the popular EDM series are also available in 21 mm working length. The application of the more agile, shorter models is particularly recommended in of the posterior molars and in patients with cranio-mandibular problems.

Full control in the dental practice
As an established Endo provider, COLTENE has been working closely with leading dentists, universities and endo experts for many years. The multitude of sophisticated treatment aids, ranging from specially hardened instruments to bio-active obturation materials, reflects the self-image of the Swiss innovation leader. True to the company’s motto “Upgrade Dentistry”, COLTENE service team regularly asks practice owners and endodontic specialists about their wishes for even more confident work in virtually all situations. This also formed the basis for the development of the production process called “Electrical Discharge Machining” (EDM for short) by the dental manufacturer’s renowned R&D department, which ultimately gave the exceptionally break-resistant files their name. The practice-oriented Endo offer is complemented by a large number of application-related workshops, training materials and personal services.

Further product information:
https://hyflex.coltene.com/
The pathway to perfect endodontics

Julian Webber introduces the latest glide path file from Dentsply Sirona that completes the WaveOne Gold reciprocating system.

By Julian Webber, UK

“The endodontic glide path is a smooth, radicular tunnel from canal orifice to physiologic terminus. Its minimal size should be a ‘super loose No. 10’ endodontic file.” John West DDS, endodontist, Tacoma, Washington, USA and key opinion leader for Dentsply Sirona.

The glide path is the starting point for all endodontic shaping procedures. It fulfills a biological requirement indicating that we can get from the orifice of the canal to the terminus, giving us a road map for all other shaping instruments to follow. Whilst some endodontists do not believe a glide path is necessary prior to starting the shaping procedure with mechanical endodontic shaping instruments, the literature is unequivocal that without a glide path ledges, blockages, perforations and instrument fracture can easily occur. In my opinion, if there is no glide path, we should not be attempting to use any nickel titanium rotary or nickel titanium reciprocating shaping files. Hand files or dedicated mechanical...
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glide path files can be used beyond a K-file size 10 to expand the working width and pre-shape the canal, creating adequate access which is essential if rotary or reciprocating instruments are being used. As the shaping file moves down the canal there is considerable torsional effect on the instrument, so if the canal is rather tight or narrow then the file can have difficulty progressing. An expanded glide path will mitigate this issue.

Mechanical glide path files follow and expand the original anatomy of the root canal. They greatly improve shaping results, reduce chair time and help to “augur” debris coronally and out of the canal, helping reduce the likelihood of post-operative pain. The original mechanical PathFile instruments from Dentsply Sirona consisted of three rotary expansion files. This evolved into ProGlider, a single glide path expansion file used in a rotary motion made from a pre-manufacture heat treatment technique known as M-Wire, which increased flexibility and provided greater resistance to cyclic fatigue. With the launch of the new generation WaveOne Gold reciprocating files in 2015, it became obvious there was now a need for a reciprocating glide path expansion file to complete the WaveOne Gold system.

Four of the original key opinion leaders involved in the development of WaveOne Gold, my colleagues, Dr. Clifford Ruddle (USA), Dr. Sergio Kuttler (USA), Dr. Wilhelm Pertot (France) and myself have now gone on to develop and launch WaveOne Gold Glider from Dentsply Sirona. We were assisted in this project by Dr John West (USA) and Drs. Berutti, Cantatore and Castellucci (Italy).

The WaveOne Gold Glider reciprocating glide path file uses the same post-manufacturing heat treatment process as WaveOne Gold. This technique gives the instrument the same distinctive gold appearance, but more importantly, it significantly improves its strength and flexibility when compared to NiTi that has not had this heat treatment. Specifically designed as a single use instrument the ring on the shaft, just as with WaveOne Gold files, will expand if the file is put through a steriliser, rendering it unusable.

Using the same parallelogram-shaped cross section as WaveOne Gold, the reciprocating motion means the backward movement of the file is greater than the forward movement, reducing the torsional effect on the instrument and greatly increasing its resistance to cyclic fatigue. It comes with a size 15 tip in a choice of three lengths (21, 25 and 31mm) with an active length of 16mm. The 11mm shaft length helps to improve access to the more difficult-to-reach areas of the mouth. Due to its flexibility and lack of shape memory the file can be slightly pre-bent, helping to improve the placement of the tip in the back of the mouth or for patients with limited opening.

The process of obtaining a glide path with a No. 10 hand file, expanding the glide path with WaveOne Gold Glider, then shaping the canal, in the majority of cases, with a single WaveOne Gold Primary file, provides dentists and endodontists with a simple technique that can be accomplished with confidence. WaveOne Gold Glider completes the WaveOne Gold reciprocating system, making the preparation and shaping of canals even easier whilst taking safety to a new level.

About the Author
Julian Webber was the first UK dentist to receive a Masters Degree in Endodontics from a university in the USA. He received his BDS from Birmingham University in 1974 and his MSc and Certificate in Endodontics from Northwestern University Dental School, Chicago, USA in 1978. He has been a practicing endodontist in Central London since 1978 and opened the Harley Street Centre for Endodontics in October 2002.

Julian has travelled abroad on many occasions to lecture to major world dental congresses and endodontic societies. Through his various workshops and hands-on courses, he has helped to train many general dentists in the skills of modern endodontic technique.