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 pulp 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.1

The pulp tissue may be exposed to the oral environment as a result of dental caries or by mechanical means when performing restorative or prosthetic 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.2–4

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.1,5

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. The treatment protocol was similar in both cases.

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 used. 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 used. 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 used.
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.7

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.8 The MAP System is very useful for precise and stable placement of the capping material in direct procedures, indirect procedures, and partial and total pulps.
Obtaining the right diagnosis is key to the success of conservative pulp therapy. An ideal case is a diagnosis of reversible pulps with no previous history of spontaneous or protracted dental pain. "It is generally accepted that the 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, although there are studies indicating that vital pulp therapy can be successful even in these situations.

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 suitable 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.

Bioactivity of the MTA is known as biomechanical and was first described by Reys and Carmona in 2009. In one in vitro study, the authors used scanning electron microscopy images to observe the integration 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 (Boghossian 1995; Reys-Carmona 2009).

However, the low drainage capacity of MTA does not allow for its use as an obturating cement. Thus, to get the benefit of this material's bioactivity, 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

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 pulpal 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 unfavourable 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 drainage; not producing chromatic alterations; having suitable working time; to set and be easy to manipulate and easy to remove if necessary; to promote cementogenesis, to be biocompatible and non-irritating to the tissues of the periapex (Kenneth M. Hargreaves 2001).

However, with the development of new materials and rehabilitative 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 exogenous compounds which interfere 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.

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