A contemporary endodontic approach using bioceramic cement

By Prof. Leandro Pereira, Brazil

Endodontics is the specialty in dentistry concerned with preventing or treating pathologies of pulpal and periapical origins. The ultimate goal is to resolve the endodontic disease and allow the affected tooth to re-establish its aesthetics and function through a complementary restorative treatment.

Obturation of the root canal system is an important step in any endodontic treatment. Its function is to fill and seal the canals to prevent their recontamination. With the evolution in knowledge of the intra-canal microbiology and the impact of new canal modelling instruments with continuous or alternating rotation, we know that it is not possible to eliminate completely the micro-organisms inside the endodontic microanatomy. However, we also know that this is not necessary for success and that the significant reduction in the levels of intra-canal infection, in most cases, is sufficient to achieve success. Thus, at the time of obturation, it is necessary to create an inter-canal environment that is unfavourable to the population growth of the remaining bacteria.

Another function of obturation is to prevent or hinder the growth of residual bacteria that were not eliminated during the cleaning and disinfection process. In order to achieve the desired objectives, obturation cements must have certain essential properties in order to be used clinically. In addition to insolubility in the organic tissue fluids, these include the capacity to fill, seal and attain dimensional stability, producing a film thickness of no more than 50 µm, good drainage; radiopacity; not producing chromatic alterations; a suitable working time, allowing setting, easy manipulation and easy removal if necessary; promoting cementogenesis, biocompatibility, and non-irritating to the periapical tissue. With the development of new materials and rehabilitative concepts in the field of adhesive dentistry, the search for two further characteristics has become increasingly important in the development of new endodontic cements. One of these is the absence of eugenol, which interferes with the strength of the bond of the resin system. The second characteristic is bioactivity, which is the capacity of a material to be integrated with the tissues and structures of the organism with which it is in contact.

The bioactivity of mineral trioxide aggregate (MTA) is known as biomimeralisation and was first described by Reyes-Carmona et al. in 2009. In an in vitro study, using scanning electron microscopy images, the authors observed the integration of MTA with dentine through deposition of numerous apatite groups on the dental collagen fibrils throughout the dentinal tubule surface in contact with the MTA. Another very interesting finding is that the authors observed that the more contact time the material had with the dentine, the more extensive the mineralisation was. This may be responsible for the superior adaptation of this material to dentine.

However, the low drainage capacity of MTA does not allow for its use as an obturation cement. Thus, in order to gain the benefit of this material’s biocompatibility, a new class of obturation endodontic cement was created, known as silicate-based cements. This designation is derived from the components that make up MTA and are present in these cements (tricalcium silicate, dicalcium silicate, calcium oxide and tricalcium aluminate).

The clinical case described in this article demonstrates the use of MTA-FILLAPEX (Angelus) with gutta-percha cones for endodontic obturation in a case of endodontic treatment performed in a single session. A 56-year-old female patient presented to the office complaining about spontaneous pulping pain in the left mandibular region that did not respond to analgesics or anti-inflammatories. All of the teeth in this quadrant tested negative to apical pulpal, as well as to vertical and lateral percussion. Thermal tests of tooth #37 showed an exacerbated, long-duration positive response to both cold and heat. The other teeth in the quadrant showed a slight, short-duration positive response to cold and a negative response to heat.

According to the classification of the American Association of Endodontists, tooth #37 had a pulpal and periapical diagnosis of irreversible inflammatory pulpitis with a normal periapex (Figs. 1 & 2). Endodontic treatment was indicated and conducted under an operating microscope, with a magnification varying between 2.5× and 4×.
12.5. Access to the pulp chamber was achieved with a #1013 spherical diamond bit, followed by a #3082 conical-truck diamond bit (Figs. 3 & 4). The finishing was done with a conical-truck ultrasonic diamond tip (E7D, Helse). After the canals had been located, a #10 K-type-file was slowly introduced to two-thirds of the initial radiographic length of the tooth. This was followed by a #25.06 reciprocating instrument (RECIPROC, VDW) with apical progression in sequences of three movements of around 1 mm in amplitude in the apical direction. With each sequence of three movements with the reciprocating instrument, irrigation was performed with 5 ml of 2.5% sodium hypochlorite, and a #10 K-type-file was taken to two-thirds of the radiographic length of the tooth. This procedure was repeated until the R25 instruments reached this pre-established length.

The next step was to establish the true working length with a foramen locator. Along the working length, the diameter of the region was verified through introduction of manual K-type files of different diameters until one of them was observed to adapt to the lateral walls of the canals. In the mesial canals, we used the #30 instrument, while in the distal canal, we used the #40. In this way and using the same initial operative sequence of preparation, modelling and irrigation, the mesial canals were prepared for the RECIPROC 40 instrument, and the distal canal was prepared for the RECIPROC 50 instrument.

After modelling of the canals, the system of canals was dried and filled with 17% EDTA-T, and an Irrisonic ultrasonic tip (Helse) was used to passively activate the substance for three cycles of 15 seconds with renewal of the substance for each cycle. After the ultrasonic passive activation, the canals were again irrigated with 5 ml of 2.5% sodium hypochlorite (Fig. 5). The main gutta-percha cones were tested and adjusted. The system of canals was then dried with aspiration micro-cannulas connected to a vacuum pump.

The MTA-FILLAPEX cement was prepared and introduced into the canals using the main gutta-percha cones (Fig. 6). The excess from the cones was removed using a heat transfer system (Touch’n Heat, Kerr) and cold compressed vertically. The pulp chamber was sealed with photopolymerisable composite resin, and the patient was sent to the dentist, who would perform the definitive restoration of the dental element (Fig. 7).

After 17 months, the patient attended control consultation, and endodontic success was evident on the radiograph (Fig. 8), owing to the absence of signs and symptoms, physiological functioning of the tooth, normality of the periapex and reabsorption of the surplus MTA-FILLAPEX.

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

A pioneer in piezoelectric endodontic micro-surgery, Leandro Pereira is a professor at the endodontics department of the São Leopoldo Mandic dental school in São Paulo in Brazil.