Non-surgical repair of a cervical resorptive defect utilizing a fast set self curing bioceramic root repair material

By Ilya Mer, Russia and Martin Trope, USA

Abstract: This paper describes the conservative treatment of a cervical root resorption defect with premixed bioceramic putty. The patient presented with a sinus tract associated with a cervical resorptive defect. Usually these lesions are treated with an external approach that results in destruction of the marginal attachment. After disinfection, a new pre-mixed bioceramic material that does not discolor was used internally to seal the defect. Follow-up shows that the sinus tract is not present and that there is bone fill in adjacent to the bioceramic material. Clinically the tooth has maintained its natural color.

Key words: Cervical root resorption, treatment, repair, pre-mixed bioceramic

Introduction
Bioceramics are ceramic materials specifically designed for use in medicine and dentistry. They include alumina and zirconia, bioactive glass, coatings and composites, hydroxyapatite and resorbable calcium phosphates, and radiotherapy glasses (1-5). Bioceramics are widely used for orthopedic applications (joint or tissue replacement), for coatings to improve the biocompatibility of metal implants, and can function as resorbable lattices that provide a framework that is eventually dissolved as the body rebuilds tissue (4). There are numerous bioceramics currently in use in dentistry and medicine. Alumina and zirconia are bioinert ceramics used in prosthetics. Bioactive glass and glass ceramics are available for use in dentistry under various trade names. In addition porous ceramics such as calcium-phosphate based materials have been used for filling bone defects. Also some calcium

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silicates (MTA (Tulsa Dental)) and Bioaggregate (DiaDent) have been used in dentistry as root repair materials and for apical root filling materials.

Properties of Endodontic Bioceramic Materials

Endodontic bioceramics are not sensitive to moisture and blood contamination and therefore are not technique sensitive (5). They are dimensionally stable and expand slightly on setting, making them one of the best setting materials in dentistry (5). When set they are hard allowing full compaction of a final restoration and are insoluble over time ensuring the superior long-term seal. The pH setting when is above 12 due to the hydration reaction forming calcium hydroxide and later dissociation into calcium and hydroxyl ions (6). Therefore when unset the material has antibacterial properties. When fully set it is bio-compatible and even bioactive. When bioceramic materials come in contact with tissue fluids, they release calcium hydroxide that can interact with phosphates in the tissue fluids to form hydroxyapatite.

Few clinicians realize that original MTA is a classical bioceramic material with the addition of some heavy metals. MTA is one of the most extensively researched materials in the dental field (7,8). It has the properties of all bioceramics i.e. high pH when unset, biocompatible and bioactive when set and provides an excellent seal over time. However, it has some drawbacks. The initial setting time is at least 3 hours. It requires mixing (resulting in considerable waste), it is not easy to manipulate, and is hard to remove. Clinically, both gray and white MTA stain dentin, presumably due to the heavy metal content of the material or the inclusion of blood pigment while setting (Fig. 1)(9,10).

Finally, MTA is hard to apply in narrow canals, making the material poorly suited for use as a sealer. Efforts have been made to overcome these shortcomings with new compositions of MTA or with additives. However, these formulations affect MTA’s physical and mechanical characteristics.

2nd Generation Bioceramics: Endodontic Pre-Mixed Bioceramics

These products are available in North America as Endosequence® BC Sealer® (BC sealer), Endosequence® Root Repair Material Paste™ (BC RRM Paste Syringeable) and Endosequence® Root Repair Material Putty™ (BC RRM Putty) (Brassefer, USA Dental LLC, Savannah, GA).

Recently, these materials have also been made available outside North America as Totalfill® BC Sealer®, Totalfill® BC RRM Paste and Totalfill® BC RRM Putty. All three forms of bioceramics are similar in chemical composition (calcium silicates, zirconium oxide, tantalum oxide, calcium phosphate monohydrate and fillers), have excellent mechanical and biological properties and good handling properties. They are hydrophobic, insoluble, radiopaque, aluminum-free, high pH, and require moisture to set and harden. The working time is more than 50 minutes, and the setting time is 4 hours in normal conditions, depending on the amount of moisture available.

In addition, Totalfill® Fast Set Putty® has recently been introduced into the market that has all the properties of the original putty but has a faster setting time (approximately 20 minutes).

Studies on Endodontic Pre-Mixed Bioceramic materials

To date, more than 50 studies have been performed on Pre-mixed Endodontic Bioceramic materials. The vast majority of these studies show that the properties conform to those expected of a bioceramic material and are similar to MTA.

Case Report

A 29 year old Caucasian female presented pointing to Tooth 11 complaining that her tooth became discolored about 4 years previously and bleaching with hydrogen peroxide performed. Clinical and radiographic examination revealed a sinus tract that traced to a resorptive defect in the cervical area of the tooth (Figure 1).

With the patients input and consent a treatment plan was devised to perform a retreatment on Tooth 11 and then surgically remove the resorptive defect. The patient understood that due to the position of the defect that the prognosis was fair.

The retreatment was initiated by removal of as much gutta-percha as possible and disinfesting the root canal. Bleeding was seen from the resorptive defect. The canal was sealed with the defect were filled with calcium hydroxide and the access sealed with IRM (Figure 2).

Two weeks later the patient presented asymptomatic. The sinus tract had disappeared and the resorptive defect was free of active bleeding. The retreatment was continued and calcium hydroxide placed into the root canal. Since the resorptive defect was dry and accessible, it was decided to use BC putty from an internal approach (Figure 3).

When the patient returned in another two weeks the sinus tract was still not present, the bioceramic was fully set and appeared to be sealing well. The root canal was completed and the access cavity sealed with a bonded resin (Figure 4).

At the six month and fifteen month follow-up the patient was asymptomatic. Probing was normal and sinus tract was not present. Bony fill in of the resorptive defect was seen (Figure 5).

Discussion

Cervical root resorption is extremely difficult to treat. In most cases, it requires treatment from an external approach because it is so difficult to get a good seal between the external surface where the resorptive tissue originates and the inner resorptive defect. The external approach is usually very destructive to the attachment apparatus and sometimes actually shortens the life of the tooth.

The bioceramic putty is easy to manipulate and was able to flow into the defect when it was free of blood. The material uses the body fluids to set and its slight expansion on setting provides an excellent seal.

The superior seal and bio-active nature of the bioceramic material explains the bone fill into the resorptive defect against the BC material.

References

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Irrigation dynamics in root canal therapy

By Prof. Anil Kishen, Canada

Irrigation dynamics deals with the patterns of irrigant flow, penetration, exchange and the forces produced within the root canal system. Current modes of endodontic irrigation include the traditional syringe method, mechanical or ultrasonic methods, as well 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 and facilitate debris removal 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 remove debris and inactivate endotoxins, and dissolve tissue remnants and the smear layer, using mechanical entrance in the root canals, as well as to allow the flow of irrigant entailing the debris out of the root canal system, in order to detach the biofilm structures and buses and permit better interaction with the root canals (physical effects).

While the chemical effects will be influenced by the concentration of the antimicrobial and the duration of action, the effective irrigation 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 effective and physical effectiveness.[3] It is important to realise that even the most effective irrigant will be of no use if it cannot penetrate the apical portion of the root canal. Thus, irrigation is required during irrigation. Ide ally, in a canal enlarged to size 50 or 55 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 irrigation exchange and high wall shear stress, while reducing the risk of perforation.

In the case of a closed-ended needle, placement should be within 1 mm short of the WL, so that optimum irrigation exchange can be ensured. The apical negative-pressure irrigation did not generate marked wall shear stress values, but allowed the flow of irrigant continuously 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 highest wall shear stress can be achieved by maintaining optimum disinfection and to circumvent the limitations of one method is recommended.

Editorial note: A list of references is available from the publisher.
FKG Dentaire: Advocating for more conservative and successful endodontic treatment

By FKG

Dubai, UAE: Cutting edge endo instruments and continuous investments in research and development has resulted in booming FKG Dentaire sales globally. Thinking out of the box, willing to create a new path and conserve dentistry and focusing on the interests of both the patient and the dentist has led to the latest launch of Vanguard endodontic files: XP-endo Finisher and IT-Apifase.

These new instruments allow the practitioner to conserve root dentine while at the same time ensuring optimal biofilm removal.

In order to help practitioners optimise their skills and utilise these new technologies developed by its engineers and top endodontists, FKG Dentaire has set-up several Training Centers around the globe. The first one opened in Dubai (UAE) in 2015, as well as the one in Oslo (Norway) in partnership with Dr Gilberto Debeiz (EndoInno), followed by La Chaux-de-Fonds (Switzerland) in 2014. The latest training centre was inaugurated last year in Mexico (Tutares-Dentaire). In 2016, following the success of the training center in Dubai and the desire to increase its teaching capacity, FKG Dentaire has decided to upgrade its Dubai Center. In addition to an increased number of work stations, partnerships have been established with other leading endodontic manufacturers like Global Microscope, Rki, as well as several other world renowned dental companies.

The Dubai Center started its 2016 activities by receiving groups of dentists and endodontists from Greece and Poland trained by Dr Bartosz Cerkaski (Poland) and Dr Andreas Krokidis (Greece).

Partnerships have been created with different continuing education organizations like CAPPMEA (UAE), Next Level Endodontics (Pr Martin Trope and University of Pennsylvania faculty (USA)) and others to organize specialized trainings to fit to the level of any dentist willing to push his/her knowledge and improve outcomes. The next day to save is the AEEDC (2-4 February 2016) and the desire to increase its teaching capacity, FKG Dentaire has decided to upgrade its Dubai Center. In addition to an increased number of work stations, partnerships have been established with other leading endodontic manufacturers like Global Microscope, Rki, as well as several other world renowned dental companies.

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